Mieszko Tałasiewicz

Trends in Logic 29

Philosophy of Syntax

Foundational Topics

Springer

Philosophy of Syntax

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CONTENTS

1 INTRODUCTION

Abstract

In the chapter some preliminary methodological issues are discussed, including the demarcation between logic and linguistics and the shortcomings of empirical base of the theory of syntax. An epistemological approach to language is sketched out and a need for the proper balance between logical aspects of natural language and vernacular usage is claimed crucial for any reliable theory of syntax and semantics. *Learnability* and *efficiency* are presented as the most important constraints to be imposed upon a logical analysis of language.

Keywords Linguistics, Logic, Methodology, Natural Language

1.1 Epistemological Background of the Problem of Syntax

Among central questions of epistemology two are the most fundamental: how language is related to the reality that we talk about in this language, and how one can rationally learn what this reality is like. Let us label these questions respectively 'the question of reference' and 'the question of method'. Certainly these two are very closely interconnected. Perhaps some solution to the problem of reference would solve the problem of method: the way in which language refers to reality would tell us how to verify the sentences of this language. But in general it can be otherwise. Equally imaginable is the case that we know what (e.g. which possible states of affairs) our sentences refer to but we do not know (*scil.* we cannot rationally justify our belief in this respect), whether they are true (*scil.* whether corresponding states of affairs are facts). Both questions can be thus discussed quite independently.

This book is about some aspects of the problem of reference: it aims at exploring the nature of syntax in its epistemological, referential role. It is important to stress this perspective, not very common today in the study of grammar, because it has some vital consequences. The most straightforward one is that we cannot ignore metaphysics. Telling what the relation between language and reality is requires not only the analysis of language but adopting some metaphysical hypothesis about reality as well.

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1.2 Language of Logic and Language of Linguistics

At least two scientific disciplines regard the research on language as their domain: logic and linguistics. Linguistics is an empirical science, logic – a formal one. The methodological difference between the two results in real difficulty: the question of how the subject of one of them relates to the subject of the other arises. In other words: is the language of linguists the same thing as the language of logicians?

At the first glance the answer is obviously negative. The subject of logic is a class of some abstract set-theoretical structures; the subject of linguistics – a corpus of recorded sounds and collected writings. However – are they really independent objects? Isn't it rather that they are different aspects of the same 'entity', closely connected to each other?

Methodological reflection would show some possibilities of convergence for logic and linguistics. Well-developed empirical sciences broadly use the results of formal research: they adopt from them some methods and many abstract structures. In the methodology of science it has been agreed that the most valuable kind of explanation must include highly general and logically fine-grained idealizing theories, whose connection to actual experiments is loose and very indirect. Why should it be different in linguistics?

This observation removes the mark of certainty from the negative answer; it is too weak, however, to validate the positive answer. The linguists still can maintain that the ultimate subject of explanation and the base of verification of the theory – no matter how logically advanced – is the corpus of usages (filtered at most by the linguist's intuition of acceptability), which is, in fact, a kind of collective physical object. The logicians at the same time can purposely discard the faintest reference to ways how people talk. Speaking about, language they would still be speaking about something totally different.

This picture fits the real situation in the thirties of the last century, when the behavioral paradigm of Leonard Bloomfield dominated in linguistics. and logic, on the other hand, consisted in the abstract semantics of Alfred Tarski, Kurt Gödel and Alonso Church, the logicism of Bertrand Russell or the formalism of Jan Łukasiewicz, quite well.

That convergence is possible was believed by Kazimierz Ajdukiewicz, who wrote: '[...] the languages studied by logicians are in many respects modelled on natural languages'.[1] On such a stance he founded the first systems of the so called categorial grammar in the thirties.[2] Those systems are *par excellence* logical calculi, however designed in such a way as to reveal some important features of natural language and to 'make some contribution to general linguistics'.[3]

[1] Ajdukiewicz (1978, p. 269).

[2] Ajdukiewicz (1967).

[3] Ajdukiewicz (1978, p. 269).

To some extent Noam Chomsky's program of generative grammar was an analogous move on the part of the linguists in the fifties.[4] Generative theory is *par excellence* an empirical theory, containing, however, important idealizations (the competence/performance distinction; grammaticality judgements vs. reports on usage, etc.) and postulating abstract theoretical entities (first of all derivational trees, but also unobservable formatives, characteristic for deep structures).

Further development of both frameworks: the categorial grammar on the part of logic and the generative grammar on the part of linguistics clearly showed a convergent character – to such an extent that around 1970 a direct contact was established between them. In No. 22 of the philosophical journal *Synthese* published in this year there simultaneously appeared several outstanding works from both sides. Articles of logicians Peter Thomas Geach (1970) and David Lewis (1970) are complemented by the work of a linguist George Lakoff (1970).[5] It was also the time when the ideas of Richard Montague became available to a wider public (esp. after the posthumous publication of the collective volume (Montague 1974a)). Those authors read and comment on each other: Max J. Cresswell's monograph (Cresswell 1973), which creatively synthesizes the logicians' stance, also extensively discusses the results of generative grammar.[6] The intention is clear: we want to speak of the same thing; logic and linguistics have the same subject – only they explore different aspects of it and use different means.

The main frameworks developed in the 1970's – pioneering but sketchy and incomplete – eventually turned into research paradigms: they generated technical 'puzzles' (using Thomas S. Kuhn's word) and the need to solve these puzzles. In the next years initial conceptions were forged into detailed theories, manifold properties were examined and – in order to find applications – numerous variants emerged (the need to implement natural language in machines being one of the most powerful engines of this process).

The belief that linguists and logicians (as well as philosophers in general) have a common field of interest and can support each other resulted in establishing a new journal – *Linguistics and Philosophy* – in 1977, which since then has been one of the main platforms of exchange between the two traditions.[7] It was where the most important conceptions and solutions concerning philosophical aspects of natural language were published or at least broadly commented, and where schools and new paradigms were formed.

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[4] Chomsky (1957) and Chomsky (1965).

[5] The very same issue of *Synthese* contains as well the paper of Robert Stalnaker (1970), also exploiting the idea of logical research in natural language, however not quite within the scope of our considerations.

[6] It is a striking contrast to the situation ten years earlier, when neither Chomsky says a word about Ajdukiewicz's works (although he should have known them), nor Ajdukiewicz – about Chomsky's (although he could have known his early works, esp. *Syntactic Structures*).

[7] Among journals situated close to the logic-linguistics interface, one can also mention *The Journal of Philosophical Logic*, *Natural Language Semantics* or *The Journal of Logic, Language and Information.*

Nevertheless, in spite of such a friendly organizational environment and a very encouraging intellectual climate for an interdisciplinary logico-linguistical co-operation, the main goal, as it seems, has not been reached: a uniform view of language.

In 1997 Johan van Benthem and Alice ter Meulen edited the monumental monograph *Handbook of Logic and Language*, which aimed at presenting the current results of this co-operation (van Benthem, ter Meulen 1997). It is indeed symptomatic that in the section in which the methods and main assumptions underlying the particular solutions are usually presented in such publications, this monography includes six (!) different sets of rules and assumptions (gathered under the heading *Frameworks*): Montague Grammar, Categorial Grammar, Discourse Representation Theory (DRT), Situation Theory, Government & Binding (being one of the versions of generative theory) and Game-theoretical Semantics. Particular Chapters reveal the fatal dispersion and mutual incompatibility of contemporary theories and research programs even more explicitly. The editors of the volume in their introduction noticed:

> In the 80's, 'frameworks' started appearing, trying to change and monopolize part of the research agenda, and authors felt the need to present their ideas more forcefully as 'theories' with appealing names, forming schools and proselytizing. Part of this may be symptomatic for a young emerging area trying to establish itself, a phenomenon well-documented in fields like linguistics and computer science. This trend toward separatism and rivaling research agendas, though it may have had positive effects in stimulating foundational discussions, has hampered communication, and generated much fortuitous competition (van Benthem and ter Meulen 1997, p. 3).

Their conclusion sounds perhaps relatively optimistic: '[B]y now, a more positive assesment of the current situation is certainly possible'.[8] It is a very moderate optimism, though.

And moderate it should be, I believe. The state of research, pictured in the *Handbook of Logic and Language* – the theoretical dispersion and separatism of the 'schools' – is symptomatic not only of a young, emerging discipline, as van Benthem and ter Meulen want to see it. It is also very symptomatic of something quite the opposite – as everyone acquainted with the discussions in philosophy of science can see – namely for a period of scientific crisis (in the sense of Kuhn or Lakatos), caused by the degeneration of a declining paradigm (or a research program), when extremely sophisticated puzzles generated in one variant of the paradigm became incomprehensible or even impossible to formulate on the grounds of even slightly different variants. The diagnosis in fact could be much more pessimistic – and such a pessimistic diagnosis was formulated indeed only five years later:[9]

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[8] Ibidem.

[9] According to the influential program of generative grammar, such a pessimistic diagnosis was formulated already in the early 1990's: '[G]enerativism, which has dominated linguistics for the

In the special 25th volume of *Linguistics and Philosophy* (2002), Pauline Jacobson publishes a paper under a much telling title *The (Dis)organisation of the Grammar: 25 Years,* which begins with a memorable phrase:

> There is no doubt that the 25 years since the launching of Linguistics and Philosophy have witnessed an explosion in our understanding of linguistics semantics. There is, however, one area in which we have arguably made little progress – indeed I wish to suggest here that we have perhaps gone backwards. And this concerns the fundamental question of overall organization and architecture of the grammar – in particular, how the systems of syntax and semantics work (or don't work) together (Jacobson 2002, s. 601).

The present book is conceived as an attempt to capture a still evasive uniform picture of language and in particular to explore what Jacobson has mentioned: the overall architecture of the grammar and its connection with referential semantics. I do not have any ambition to compare countless contemporary theories of language and to criticize each of them according to their own standards. It would be a very valuable enterprise, I suppose, going, however, far beyond the scope of one book and perhaps beyond the capabilities of one person at all. Instead, I would rather go back to the 'roots' – analyze some deep intuitions underlying the foundations of syntax and explore the initial conditions for the possibility of building and interpreting compound expressions. This work is therefore rather pre-theoretical than comparative or critical. Hence the title: *Philosophy of Syntax. Foundational Topics.*

Before we proceed to the specific discussion, let us first take a look at two methodological 'sins' that in my opinion hampered – and perhaps still hamper – working out a uniform research perspective and a subject common for both disciplines: the 'haughtiness' of logic and the 'pretentiousness' of linguistics.

1.2.1 The 'Haughtiness' of Logic

The opinion formulated by David Lewis in the following words is widespread among logicians:

> I distinguish two topics: first, the description of possible languages or grammars as abstract semantic systems whereby symbols are associated with aspects of the world; and second, the description of the psychological and sociological facts whereby a particular

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past 35 years, has now reached a state of intellectual bankruptcy; […][it] has now retreated to a position where in effect it is conceded that it is not clear whether it is possible, even in principle, to write a generative grammar of *any* language' (Harré and Harris 1993, p. 14).

> one of these abstract semantic systems is the one used by a person or population. Only confusion comes of mixing these two topics (Lewis 1970, p. 19).

A similar idea, somewhat more elaborated on, was expressed by Cresswell.[10] He introduced a distinction between abstract languages (*a*-languages) and really used languages (*u*-languages) and maintained that we can *divorce* the theory of meaning and the theory of usage in such a way that we would elaborate on the theory of meaning for *a*-languages and the theory of usage would only tell us which of these *a*-languages are appropriate models for a given *u*-language.

Such a view is *prima facie* plausible. Indeed, no good comes from mixing logical research with some accidental psychological or sociological facts that are responsible for differentiating ethnical languages, dialects and idiolects. However, some deeper insight would reveal a certain incompleteness of this view. It is not so, namely, that only the purely abstract properties of logic, eternal and necessary, on the one hand, and the purely contingent circumstances of actual choice on the other hand decide about language. There is also a whole class of parameters that are not logical but in an important sense not contingent either, common to all people and populations. These parameters can in many ways restrict Lewis's 'possible abstract systems'. Ignoring them may have the result that *none* of the discussed logic-based abstract systems would be used by a person or population (*resp.* none of the discussed *a*-languages would be a proper model of any *u*-language).[11]

We can, of course, call some purely abstract systems 'languages'; but we have to keep in mind that such terminology is a purely technical, internal matter of logic; a 'language' in such a sense may have nothing – or very little – in common with the *phenomenon* of language: something to be explained in the context of the problem of reference, something that is a tool of human cognition. Natural language is at the same time both an empirical – physical, physiological, psychological – entity, on the one hand, and an abstract system on the other. Certainly, it consists of inscriptions or sounds – but equipped with meanings and structures. It is the meanings that allows those inscriptions and sounds to enter semantic relations and refer to the world; it is the structures that allow those meanings to combine.

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[10] Cresswell (1973, pp. 2–3).

[11] Fodor and Lepore (2002, p. 62) discuss a somewhat similar way of argumentation. They notice that wherever the problem of the capability of the human mind to capture a structure of an expression arises, some researchers would like to relegate this problem to mere psychology. Answering this, the authors introduce the *Silly Argument*: 'it is stuff about your muscles that explains why you can't lift this rock, therefore it's not stuff about what the rock weighs' (s. 62). This argument shows – by *reductio ad absurdum* – that in such cases *both* the cognitive capabilities of the subject *and* the logical complication of the material count. The same structure can be captured by some people and by some others – not. But the same person can capture some structures and some others – not. In extreme cases some logical structures can resist the cognitive skills of all people. It is interesting that so often the abstract systems explored by logicians belong precisely to the last category.

Language, thus understood, can and shall be the subject of logical research. But the logician cannot usurp the absolute sovereignty and legislature in this matter. It is no longer sightseeing in possible worlds, but a confrontation with something real. We need (possibly formal and abstract) *representations* of real phenomena, processes and systems (or – as you wish – a logical form that is realized in the concrete world[12]). These representations cannot be constructed at will. Firstly we have to *recognize* some regularities and structures in the world that will put some constraints on the representations. Research of the representations preserves its logical – or broadly speaking: philosophical – character. But now there is some new element in it, typical for natural science and alien to speculative philosophy: the curiosity how it *really* works. The structure of natural language just isn't a purely logical, abstract matter.

1.2.2 The 'Pretentiousness' of Linguistics

Let us now see why the most theoretically advanced program in linguistics – generativism – failed to properly determine its own subject (properly from the epistemological point of view); and what can be done to mend it. My claim is that it was a sort of 'pretentiousness' of generative grammar to be blamed for it. A 'pretentiousness' consisting of very high theoretical ambitions combined with substantially lower methodological credibility.

As I have said above, the first impulses from generative grammar certainly pushed linguistics in the right direction. Chomsky was the first to properly acknowledge the formerly known but commonly underestimated distinction of linguistic performance/competence and to stress that general linguistic theory should be rather a theory of the latter. By this move he liberated linguistics from the ultra-empiricism of Bloomfield's behaviorism and entered the *par excellence* philosophical debate between empiricism and rationalism (in traditional terms) or radical empiricism and moderate empiricism (in contemporary wording), taking the side of rationalism (or moderate empiricism). Chomsky noticed and showed to other linguists that the structure of an expression is a theoretical object reachable only indirectly (something quite obvious for logicians).[13] These views, quite radical at the time, drawing linguistics' methodology closer to the role-modeling methodology of natural sciences, firstly eventuated in a massive criticism of the betrayal of

[12] I am quite aware that from some point of view logical forms exemplified in concrete objects are to be counterposed against the abstract representations of these objects. Namely from the point of view of the controversy about the ontological priority of individuals and abstracts (e.g. when we ask whether it is so that regularities in the world are possible because the world has a mathematical structure or perhaps it is so that it is mathematics that is possible because we can notice some regularities in the world). However, since I am not in a position here to take sides in this controversy, I am apt to consider the difference as a mere difference in wording.

[13] Cf. Chomsky (1965).

the (outdated) ideals of empiricism but later brought Chomsky the fame of a great reformer of science. It also made possible the mentioned above development of linguistics convergent with some logical projects.

Convergent to a degree, but aiming at much higher goals. The ambition of generative grammar was to explain in terms of the uniform syntactic theory the faintest nuances of the language intuition of the 'competent speaker' of any native language. This undeniably high ambition was accompanied by a very limited empirical background. To accomplish this goal, a grammarian had to develop an extremely fine-grained classification of linguistic phenomena and posit an enormous set of very complicated syntactic rules (of a very minutely restricted application range), mutually interdependent. The only source of this whole plethora of phenomena, rules, restrictions and allowances, the only key to the syntactic structures of a language, according to Chomsky, was the intuitive acceptability of some expressions of this language and inacceptability of some others.

To substantiate this ambition, Chomsky claimed that linguistic competence can tell us what is grammatical and what is not; and that we have a sound access to this competence: we can make reliable grammaticality judgments (intuitively), even if our performance does not always match them. The difference – says Chomsky – is due to 'such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, errors […] in applying [one's] knowledge of the language in actual performance. […] [U]nder the idealization [that these conditions do not affect the language user] is performance a direct reflection of competence' (1965, pp. 3–4).

This claim is hardly plausible. This 'hidden' linguistic intuition is for sure not a purely syntactic intuition. It emerges (whatever is the exact source of it) along with the acquisition of the whole language and depends on all aspects of linguistic communication, especially on the broadly understood pragmatic aspect (i.e. the capability of using extralinguistic context in communication) and on the semantic aspect.[14] This intuition must acknowledge also the fact that language has many functions (apart from the descriptive function it also has expressive function, persuasive function, performative function and so on). Due to all these interdependencies, taking intuition as the sole base for grammaticality judgments may lead us towards seriously mistaken conclusions.

Let us take for an instance the example analyzed by Chomsky: 'This is the cat that caught the rat that stole the cheese'. Chomsky suggests that this sentence should be parsed as (P1) [this is [the cat that caught [the rat that stole the cheese]]].[15]

Such a parsing undeniably has some logical justification: [the cat that caught [the rat that stole the cheese]] is a complement phrase of the verb 'is' and [the rat

[14] 'There is much empirical evidence of the interplay between these two aspects [syntactic and semantic] of language acquisition – the child uses syntactic cues to make good semantic 'guesses', and uses semantic cues to acquire the syntax of, e.g., verbs' (Dresner 2002, p. 431).

[15] Chomsky (1965, p. 13).

that stole the cheese] is a complement phrase of the verb 'caught'. This parsing however has nothing to do with *intuition*. All users would make a pause in different places than marked above by the brackets, namely they would say it like this:

(P2) [this is the cat [that caught the rat [that stole the cheese]]].

Why would they say it like this? - that is the question. I don't think I will risk much if I say that the main reason here is to stress the first order structure of the sentence, i.e. that it is about some cat. Only further analysis (not always necessary for certain communicative purposes) reveals that *de facto* we are speaking not about just some cat, but about the cat that caught some rat. And still further we are shown that it is not just a rat, but the rat – the rat that stole the cheese. The parsing proposed by Chomsky, although it perhaps truly reveals the actual syntactic structure of the sentence, is ill-adapted for communicative purposes: it allows for interpretation of the sentence only if the whole parsing is done, whereas (P2) gives us some information even if the parsing is not complete (and we can decide whether it is enough information for us; if yes, we can parse no further). It is more than likely that the intuitive judgments would favor P2 instead of P1 (and thus they would not lead us to the correct syntax).

Convincing arguments have been given in a refreshingly sober survey by Carson T. Schütze, *The Empirical Base of Linguistics* (1996). Schütze argues that the intuition we have reflects itself in *acceptability* judgments, not *grammaticality* judgements; and that acceptability is a far cry from grammaticality:

> Linguists might construct arguments about the grammaticality of a sentence, but all that a linguistically naïve subject can do is judge its acceptability… I [Schütze] will follow the existing literature in treating grammaticality judgment and acceptability judgment as synonyms […] with the understanding that the former is unquestionably a misnomer, and only the latter is a sensible notion (1996, pp. 26–27).

In due course Schütze recalls a substantial number of examples showing that numerous factors actually do interfere with *grammaticality* judgments in real cases. The judgments depend on the position of the anomaly in the context (whether the anomaly is closer to the beginning of the sentence or rather not; 1996, pp. 75–76), on the number and label of the degrees of the measurement scale (p. 78),[16] on whether the subjects were asked to judge the well-formedness of some expressions before or after the expressions were given (p. 90), on linguistic training[17], overall literacy and education, on presuppositions about the nature of

[16] Some scales may lead to circular judgments: (a) is better than (b), (b) is better than (c) and (c) is better than (a) – cf. Schütze (1996, p. 80).

[17] One might argue that the very dependence of judgments on metalinguistic intuition rather than a linguistic one is one of the serious misconceptions of linguistic methodology and may lead to wrong inferences. C.f. for instance Johnson (2004, p. 76), where an inference is made from the assumption that speakers have access to the meaning of proper names – which is a semantic competence – to the conclusion that they should *eo ipso* know whether the names are descriptions or directly referring terms (which shall be called rather the *semanticist's* competence). Schütze notices such a danger in the theory of syntax, too (e.g. 1996. pp. 56, 90).

the world (p. 127), on the experimental setting (the formulation of instructions, order of examples, number of repetitions, etc.), on the register of the given usage (like the spoken/written modality), on extralinguistic context, on communicative utility, on parsability (length or the number of embeddings) and on many other things.[18]

Keeping this in mind, we may realize that intuitions are not empirical primitives but complex behavioral performances' (Bever and Carroll 1981 after Schütze 1996, p. 50) and that 'in many ways, intuition is less regular and more difficult to interpret than speech' (Labov 1972 after Schütze 1996, p. 204).

It must be admitted here that Schütze believes (however weakly) that the methodology of linguistics he pictures in such dark colors may perhaps improve, provided linguists would start scrutinizing their experiments and verifying the data as minutely as psychologists do. But, frankly speaking, there is little hope, I am afraid.

Firstly, apparently they didn't start scrutinizing. The personal intuitions (or commitment or mere fancy) of particular linguists continue to be the sole ground for assessments of analyzed examples, hypotheses and theories. Many linguists are still happy and comfortable with providing armchair-experiments as the main tests for their ideas,[19] and the diagnosis given by Rom Harré and Roy Harris in their preface to *Linguistics and philosophy: the controversial interface*: 'The bankruptcy of generative linguistics and its failure to provide adequate theoretical foundations for its own linguistic practices' (Harré and Harris 1993, p. ix) still sounds up-to-date.

Secondly, even if the methodology were radically improved, most probably it wouldn't help much. A few glimpses into Schütze's examples of proper scrutiny can show that the sole effect of this scrutiny has a purely negative character: properly scrutinized results just do not support the hypotheses they were believed to support any longer: they are *de facto* **removed** form the empirical base of syntax. And it is not an unfortunate coincidence. To see why not, let us return for a moment to the general methodology of empirical sciences.

Linguists are apt to justify their need for empirical 'tests' by saying that in the absence of such tests their claims would be 'unfalsifiable' and *eo ipso* 'unscientific'. To some extent it is understandable. Within some special sciences the most widespread and most influential methodological ideas are still those advocated by Karl R. Popper since the nineteenthirties, especially the idea of falsifiability as the criterion of the demarcation of science. However, contemporary philosophy of

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[18] Among those other things a substantial, although a bit embarrassing, one is – so to speak – the wishful thinking of the experimenters: Schütze recalls examples of research where serious changes in linguistic theory were motivated by very controversial and questionable data; for instance a sentence was claimed 'ungrammatical' when it was fully acceptable for 45% of informants and unacceptable for only 18% (1996, p. 40). In other cases [i]f the results go the right way, they are taken as evidence; if not, they are dismissed as performance artifacts' (1996, p. 70).

[19] See – among many other examples - von Fintel (1997), Schenner (2005).

science teaches us that the falsifiability (or testability) criterion must be regarded with a very restrained attitude, more like a guideline than an actual rule. The works of Thomas Kuhn in the sixties or Imre Lakatos in the seventies have shown that strictly understood falsifiability is beyond the reach of most theories (as predicted by the so called Duhem-Quine thesis): too many various assumptions, hypotheses, and background theories must be tested together. Precisely such a situation is witnessed in the matter of language. As pointed out above, we are facing a sort of semiotic holism – semantic, syntactic and pragmatic aspects permeate each other and together with the aspects of overall psychological architecture of human cognition[20] form one of the most complicated systems of interdependencies ever inquired into. We can hardly falsify anything here – in any methodologically valuable sense of the word – unless we are given a complete and sound empirical theory of all the aspects of language (let us abbreviate this by 'CTLC' – for Complete Theory of Language and Cognition). It is far harder to support any theory.[21]

And perhaps we will never be given such a theory. Perhaps the whole idea that 'whatever form the competence takes in mind, it implicitly ascribes (perhaps some degree of) grammaticality or ungrammaticality to each string of words' (Schütze 1996, p. 20) may be mistaken.[22] Schütze acknowledges this possibility: 'It is conceivable […] that competence in this sense of statically represented knowledge does not exist. It could be that a given string is generated or its status computed only when necessary, and that the demands of the particular situation determine how the computation is carried out, e.g., by some sort of comparison to prototypical sentence structures stored in memory. […][S]uch a scenario would demand a major rethinking of the goals of the field of linguistics […]' (1996, p. 20).

Indeed, I believe that such a rethinking – not only of the goals of linguistics, but of the whole language business – is needed and urgent now. Language is not just behavior; it is meaningful behavior. And meaning is not only the matter of fact; it is also the matter of logic.

[20] 'We must recognize that linguistic semantics is not an autonomous enterprise, and that a complete analysis of meaning is tantamount to a complete account of developmental cognition' (Langacker 1991, p. 4).

[21] It is perhaps worth some emphasizing that the knowledge about some or even many of the factors interfering with (or counting into) our linguistic competence is at most sufficient to show that this or that scrap of evidence does not support what it was intended to support. For counting anything as positive evidence in favor of any hypothesis we should have the *complete* knowledge of *all* relevant factors (as we do have – to our knowledge – in physics, for example).

[22] Consider a following example: 'If there isn't a donkey in the stable, we usually clean it'. Whether this sentence is grammatical or not is a matter of what designate a language user is going to fancy for the pronoun 'it'. If one takes 'it' for 'a donkey', the sentence is ungrammatical. If, however, he takes 'it' for 'the stable', the sentence is perfectly well-formed. One cannot say whether it is grammatical or ungrammatical as it stands, without asking further questions.

1.3 Towards a General Perspective

The problem we are facing – the problem that the ‘haughtiness’ of logic and the ‘pretentiousness’ of linguistics attempt to pass by – is precisely the one that bothered Peter Thomas Geach when writing his *Program for Syntax* (Geach 1970). Geach tried to find a right balance between a logician’s negligence towards the ‘idiotism of idiom’ – ‘ordinary languages are […] cluttered with idioms of no logical interest’[23] – and the empiricist’s curiosity about what is ‘in the vernacular’.[24] In other words – making a theory of syntax, we want to confront it with the natural language, but not with the idiosyncrasies of its traditional grammar, which can be of a historical, psychological, sociological, and wholly accidental nature.

As Lloyd Humberstone points out (2005), Geach was not quite successful and the problem is still open.[25] I daresay it is one of the most serious, and most urgent as well, problems of the philosophy of language now: to find the right balance between logic and the ‘vernacular’.

In search for this, let us return again to the philosophy of science. In the eighties and nineties the works of Larry Laudan, Bas van Fraassen, and many other eminent philosophers established as common background knowledge that the judgment of the rationality of a scientific theory requires a complicated discussion about the aims of the theory in question; the possible means leading to these aims; the degree of fulfillment of these aims on the one hand, and the relations among various aspects of the theory, or between theory and its theoretical and practical environment on the other. Gradually, in philosophical discussions about rationality, the idea of falsifiability or testability became replaced by the idea of the best explanation; the quality of explanation provided by a given theory being quite independent of its testability. In cosmology, for instance, theories and hypotheses that do not and cannot predict any particular test possible even in principle to perform have been competing for years. Methodological judgment about these theories refers to different criteria.

Quite analogously we can proceed in the theory of syntax (at least until we have a CTLC). We can – and we are methodologically entitled to – adopt *the postulate of methodological autonomy of syntax*, which says that the predictions of the theory of syntax are not to be tested directly against either the corpus of recorded expressions or the intuition of acceptability (regardless the linguist’s intuition or his informants’ intuition). In particular, we can, and are entitled to, accept that some expressions that are, according to our theory of syntax, entirely correct syntactically can simultaneously be – for some reasons – weird, unnatural or even totally unacceptable.

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[23] Geach (1991, p. 273).

[24] Geach (1970, passim).

[25] Cf. also Tałasiewicz (2007).

What is then to guide us in choosing a particular theory of syntax? What are the criteria of acceptance of such a theory? Well, we need to consider how a given theory suits the explanatory purposes that we pose for the general theory of language. Among them we count explaining how the reference of simple expressions combines with the reference of the compounds,[26] identifying and describing logical relations among meanings of different expressions, discovering amphibologies and explaining nuances in meaning, difficult or impossible to detect or attribute properly without some subtle analytical tools.

Grammaticality understood as being a correctly structured expression according to a given theory of syntax would then be identified with fulfilling a certain logical condition – discussed further below – rather than with the notion of well-formedness according to traditional grammar.[27] The latter turns out to be a much more general – and vague – notion. Traditional grammar plays multiple roles. Revealing syntactic structure is only one of them. To enumerate and thoroughly examine the others is a genuine task for the linguists and exceeds the scope of my work, although it wouldn't be risky to mention two or three of them: the rules of traditional grammar help to learn the meanings of new words and the nature of their designates,[28] enable child language acquisition[29] and faciliate communication.[30] Such a distinction would allow us to concentrate on the logical aspects of syntax without being bothered by the 'idiotism of idiom'.[31]

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[26] The task for the theory of syntax is often formulated as the explanation how we can obtain (a purposely general term: one can substitute: 'derive', 'generate', 'produce', 'receive', or whatever here) an unlimited number of *well-formed* expressions having at stock only a limited, relatively small inventory of directly learned expressions (for reasons discussed below I would refrain from using here the word 'lexicon'). It is stated more or less like this by Chomsky (1965) or Katz and Postal (1964). From the epistemological point of view, however, such a task is highly unsatisfactory – generating the set of well-formed expressions is of little use to us. It is a long way from here to the proper *understanding* of these expressions, which is the point of epistemological interest.

[27] 'Grammar' would thus have many senses. I would consider as grammar any particular theory of syntax as opposed to the general theory of syntax (understood as a whole discipline) on the one hand and to traditional grammars of particular languages (as taught in schools) – on the other. The first contrast is usually easily noticeable in context. The second may cause some trouble since in certain places both senses of the term are appropriate. In such cases I will extend the term to 'logical grammar' and 'traditional grammar' respectively.

[28] Cf. Johnson (2004, p. 59): 'we can learn a lot about the meanings of the words and classes of words by examining their differing patterns of grammatical distribution' (an observation attributed to J. L. Austin).

[29] Cf. Johnson (2004, p. 70).

[30] Many rules concerning anaphora just beg to be considered as tools serving such a purpose.

[31] It would also help us to deal properly with such claims as the one posed by Ronald W. Langacker: 'I conceive the grammar of a language as merely providing the speaker with an inventory of symbolic resources, among them schematic templates representing established patterns in the assembly of complex symbolic structures' (Langacker 1991, p. 16) – e.g. by addressing them to traditional grammar only.

But what about the former, logical notion? How are we going to anchor it within the 'vernacular' without restoring to any kind of acceptability or any kind of grammatical well-formedness whatsoever? What parameters 'that are not logical but not contingent either' do count?

Well, it would be a nice thing to have them put into a catalogue, but that too goes far beyond the aims and goals of this book. Undoubtedly these parameters – the features of a real language – are varied as to their rank and the degree of generality. Some of them are biological or anthropological, some – purely epistemological. A few minor ones will be introduced and justified in the course of the matter. Here let me concentrate on two of the most important – and very intuitive as well: *learnability* and *efficiency*.

Both were considered by Barwise and Perry (1983) as essential for the proper analysis of language; the authors also properly addressed the charge of neglectig them.[32] In *Situations and Attitudes* the notion of efficiency – the feature that the same expressions can be used in different ways, places, times, and by different persons to say different thing – plays the central role. In the present book I will also return to this notion, however mainly in the defensive parts, when arguing against some 'linguistic intuitions' allegedly contradicting my proposals (I will point out namely that these intuitions may concern a 'different way' of saying things). I will draw positive support for the proposals in the first place from what I call *the postulate of learnability*. It says that:

> A theory of language, also in its logical aspect, should harmonize with practically possible ways of language acquisition, and guarantee that all information about the language in question, required for using this language, is possible to obtain in such ways – generally speaking – in which it is actually obtained in the process of learning. [33]

Such a postulate is certainly not a novelty. Before Barwise and Perry it was advocated for example by Willard van Orman Quine (1970). It remains in the sphere of mere declarations too often, though. Max Cresswell, for instance, literally accepts the postulate of learnability: 'A theory of language use must be able to show how it is that the meanings of the symbols and expressions of a language can be learnt by human beings'.[34] He makes little effort, however, to fulfill this postulate, and frankly speaking this is more than natural. This particular passage is evidently at odds with the spirit of the rest of Cresswell's monography, and particularly with the idea of *divorce* of the theory of meaning and theory of language use. If we

[32] 'A preoccupation with the language of mathematics, and with the seemingly eternal nature of its sentences, led the founders of the field to neglect the efficiency of language. In our opinion this was a critical blunder, for efficiency lies at the very heart of meaning' (1983, p. 32).

[33] This postulate has a restrictive, not constructive nature. It does not say that logical theory of language must *contain* or *entail* any particular sub-theory of language acquisition. It just says that it cannot contradict what we already know about acquisition.

[34] Cresswell (1973, p. 49).

give our consent to such a radical separation, we will deprive ourselves of all possibilities to say anything about meaning in the theory of use.

Whatever the declarations are, the postulate of learnability should be realized in practice (in the practice of theory-making, to be precise). In practice, as it turns out, it is quite a strong tool. Taken seriously it allows to end many important controversies or at least provide interesting arguments for certain sides. That's why it is worthwhile to take a closer look at the intuitions that lie behind it.

For now the justification of the postulate has been quite general – just that it promotes harmonizing a theory of language constructed by logicians with empirical realities (which is good in the light of the general epistemological assumption of present research). However, it is quite obvious and well-known that the extracting and describing of the abstract structure of a language must be grounded in many idealizations. Here the question arises, why on Earth can we not treat the problem of learnability as a victim of such an idealization?

The thing is that idealizations have no value unless they help us see things in a simplified and ordered way (without irregularities and immaterial complications), and thereby discover patterns normally hard to perceive. They cannot lead us to omit the constitutive aspects of things or to postulate something non-existent as an important part of the matter.[35] There are at least two reasons why learnability can't be a victim of idealization.

Firstly, legitimate idealizations do not concern essential features. In search for a clear picture, we can put aside the vagueness of expressions, the metaphorical character of most of our speech acts, situational context, bad pronunciation or grammatical errors. We abstract from these phenomena although they are present or even predominant in an everyday speech, because explaining them in a theory would complicate the theory beyond reasonable level, and because language without them is still a language. We can, if we are forced to – however with great pain and effort and only for a short time, perhaps – we can speak clearly and grammatically; we can explicitly describe the context, we can give regulative definitions of our terms and try to speak literally. We cannot speak – even with ultimate pain and effort – unless we had learnt a language. Learnability is an essential feature of language.

Secondly, ignoring acquisition *a limine* decides that in our theory we cannot consider the possibility that a general way of acquisition can have an impact on the structure of the language and on such fundamental issues as reference. Meanwhile, very strong intuitions, close to certainty, speak in favor of the view that there is such an impact, quite strong, even if the mechanism of the impact is still not thoroughly explained. Assuming even – contrary to the most plausible predictions – that there is no such impact, it should be established as a result of an inquiry, as a thesis of a theory, not as an axiom or entrance assumption.

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[35] The theory of idealization is a well-developed part of the philosophical methodology of science; some important work here has been done by the so called Poznań School gathered around Leszek Nowak. Cf. e.g. Nowak and Nowakowa (2000).

Thus, putting aside the problems of learnability is surely a serious methodological mistake; and most probably a material one, too. It is serious because it influences not only the theory of natural language, but practically the whole of logic as well. Even the most fine-grained abstract systems, unless they are totally uninterpreted semantically, are grounded in the intuitions shaped with and by the first language we have learnt to speak. The most detached abstractions are founded in 'mummy', 'daddy' and 'doll' because practically the highest metalanguage for all languages, even those most abstract, is natural language.

Let this be the sketch of the background for following details. In Chapter 2 I will consider the fundamental notions of the theory of syntax and analyze the intuitions behind them. In particular I will consider the problem of what it means that an expression is grammatical, or in my preferred wording, syntactically coherent. In Chapter 3, I will discuss the problem of reference – in the light shed by the theory of syntax. In Chapter 4 I will try to formulate some tentative general rules for parsing concrete sentences and suggest some strategies for interpreting expressions thus parsed.

The background itself will remain unfinished. I am not in a position here to give a complete account of literature of the subject; I cannot specify the exact assumptions I will adopt, either. The postulate of methodological autonomy of the theory of syntax or the postulate of learnability are more guidelines, showing the general direction of my work, than actual rules or formal axioms. It couldn't be otherwise, though. The present book is designed to be a discussion about the most fundamental assumptions; declaring them in the Introduction would be a *petitio principii*. Let us end the preliminaries and proceed to the heart of the matter.

2 SYNTAX

Abstract

In this chapter the foundations of categorial grammar are discussed. Firstly, the core notions stemming from Kazimierz Ajdukiewicz's seminal works: functoriality principle, semantic category, syntactic position – are introduced and analyzed. Secondly, the postulates for the theory are identified and confronted with some counter-intuitions. Thirdly, some further modifications of classical categorial grammar are examined and evaluated. Finally, the main features of categorial grammar in general are highlighted and formed into arguments against different kinds of grammars.

Keywords Categorial Grammar, Montague Grammar, Generative Grammar, Functoriality Principle, Atomicity Principle, Interchangeability Principle, Semantic Categories, Syntactic Positions, Syntax-Semantics Interface

2.1 The Functoriality Principle

One… to rule them all, One… to find them
One… to bring them all and in the darkness bind them

J.R.R. Tolkien, *The Lord of the Rings*

There are two large groups of grammars distinguished according to whether they conform to the *Functoriality Principle* (FP). Roughly speaking – a more fine-grained definition will be discussed in the next section[1] – the FP says that a compound expression is grammatical (or syntactically coherent) only if we can distinguish precisely one main part in it – a functor, which somehow binds together the remaining parts – the arguments – subordinated to it. Consequently, the parts of any compound are not level, but hierarchical. Grammars that honor the FP are *Categorial Grammars* (CG); those which do not are the so-called *generative grammars*.[2]

[1] A more poetic one is given as a motto.

[2] It is precisely the relation to FP which distinguishes categorial grammars from generative grammars – not having 'categories', as it is sometimes wrongly inferred from the terminology. There are some sorts of categories in generative grammars as well as in categorial ones.

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It has been shown that a relation of weak equivalence holds between some of the grammars from both groups (which means that they generate the same set of compound expressions out of the same set of atomic expressions).[3] Certainly, a formal proof that the two grammars belonging to fundamentally different groups can be weakly equivalent was an important finding. However, the importance of this fact has been massively overestimated. Thus it may perhaps be worthwhile to stress that weak equivalence does not give the slightest reason to give up comparing relevant grammars. Let us consider, for example, that from a formal point of view any given grammar cut down to a finite (albeit very large) number of compound expressions is weakly equivalent to a mere list of expressions. And it is obvious that all factual languages (both human and machine ones) have only a finite number of expressions: used or merely thought of or just technically computable.[4] Assuming infiniteness is only a technical trick, sometimes harmless, sometimes not. It is notable that Barwise and Perry, who aimed at a semantics suited for every-day language, very strongly stress the finiteness of all sets in their representation (Barwise and Perry 1983, p. 52). Thus, if a formal weak equivalence were something crucial, it would make little sense to bother about any grammar at all. Yet it makes much sense, as we all know. If we want to understand how language works and how it is that people say and understand compound expressions, it will make much difference whether we have a grammar or a list (of – say – billions of billions of entries). We must have a grammar, not a list – no matter that they are weakly equivalent. And it will make a difference what kind of grammar we have, of course.

2.1.1 Three Levels of FP

Let us take a look at the two classical wordings of the FP from the pioneering works by Kazimierz Ajdukiewicz:

> In every meaningful compound expression, the relations of functors to their arguments have to be such that the entire expression may be divided into parts, of which one is a functor (possibly itself a compound expression) and the others are its arguments (1967, p. 212).[5]

> Every meaningful and unambiguous expression, consisting of more than one word … can be decomposed without any residue into its components in exactly one way, so that one of

[3] Cf. Bar Hillel et al. (1960).

[4] Consider a language with 10^{100} words and 10^{100} places in compound strings. This is far beyond any present or future possibility of computation; yet still a finite number.

[5] I have revised the English translation of this passage in order to better reflect the original formulation.

> those components relates to others and connects them into a meaningful whole (1978, p. 270).

> The single distinguished element is the expression's main operator, while the remaining ones are this operator's arguments (1978, p. 271).[6]

It is immediately clear that the latter wording is in some respects much more general than the former; in fact, the FP cannot be formulated any more generally than that. In particular, this wording does not say anything about the kind of expression the operator needs to be, other than saying that it has to *somehow* bind together its own arguments. The earlier version is more specific, stating that this binding element is a functor and that, moreover, it can itself be a compound expression. (It must be noted here that some syntax calculi rule out compound operators.)

This is not to say, however, that at some point Ajdukiewicz decided to back out of the more specific formulation. Quite the contrary, in fact. The later wording ,composed some 25 years after the first one, is accompanied by an even more detailed characteristic of the operator:

> If expression *A*, which denotes α can be completely decomposed into expressions *B*, C_1, C_2, ..., C_n which denote respectively β, γ_1, γ_2, ..., γ_n and β is a function which to objects γ_1, γ_2, ..., γ_n in this order assigns uniquely α, then *B* is in *A* the main operator with C_1 as its first argument, C_2 as its second argument, ..., C_n as its *n*–th argument. (Ajdukiewicz 1978, p. 281).

It is spelled out clearly here that an expression serving as an operator has to denote an object belonging to a specific ontological category, *scil.* a function rather than an individual – and a specific kind of function at that, namely $X^{Y1x \ldots xYn}$, where X is a set of possible correlates of a compound expression, and Y_1, ..., Y_n are sets of possible correlates of the functor's arguments.[7] We will be discussing such functions at length here, so, for convenience's sake, I suggest referring to them as to Ajdukiewicz functions from now on.

If we combine both the quoted texts by Ajdukiewicz and throw in the elaboration accompanying the latter one, we get the following three-level hierarchy of what can be said about a constituent expression within a compound, according to the FP:

1. (FPa) *x* (plays the role of) operator/argument;
2. (FPb) *x* (is a) functor/argument of a specific kind;
3. (FPc) *x* (denotes an) Ajdukiewicz function/something else (an individual, a set of individuals, a non-function relation, a different kind of function, etc.).

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[6] Cf. also Ajdukiewicz (1979, p. 87).

[7] Cf. Suszko (1960, p. 69).

2.1.2 Terminology

This three-level hierarchy was already causing terminological problems in Ajdukiewicz's classical texts. In many works (e.g. Ajdukiewicz 1967, Cresswell 1973) the syntactic role of expressions is described using a single-level characteristic, by indicating their *semantic* (Ajdukiewicz) or *syntactic categories* (Cresswell). In these works we are dealing with the (FPb) characteristic. In others (e.g. Ajdukiewicz 1978, Montague 1974a) we already have a two-level characteristic in which a distinction is made between the *syntactic* and *semantic categories* of a given expression, with Ajdukiewicz dealing with the (FPa) and (FPc) levels, and Montague with the (FPb) and (FPc) levels.

Both these conventions, the single- and the two-level, are poor description tools, preventing straightforward discussions of specific aspects of syntax, forcing authors to resort to complex explanations and eliminating any hope for conceptual clarity. The two basic terms of 'syntactic category' and 'semantic category' – or any one of them – are applied to structures which we intuitively sense or explicitly demonstrate to be of a three-level nature. Thus, there is no agreement among authors as to whether 'syntactic category' refers to the (FPa) level (Ajdukiewicz 1978) or the (FPb) level (Montague 1974a, Cresswell 1973), or whether 'semantic category' refers to the (FPb) level (Ajdukiewicz 1967) or the (FPc) level (Ajdukiewicz 1978, Montague 1974a). As we can see, even individual authors cannot make up their minds on this issue (cf. Ajdukiewicz 1967 and 1978).

This terminological confusion was already noted by Cresswell (1977, pp. 257, 259), who, however, limited his comments to a cursory justification of his earlier convention, in which categories are deemed syntactic because they belong to syntax theory. A similar explanation strategy was adopted by, among others, Claudia Casadio (1988, p. 95), who, unlike Cresswell, was referring to semantic categories and argued that the ultimate objective of syntax theory is the semantics of compound expressions. The editors of *Categorial Grammars and Natural Language Structures* (Oehrle et al. 1988) decided to play it safe when characterizing categorial grammars in the Introduction to their publication, and took care to avoid attaching any adjectives to the word 'category' – dividing expressions into categories, pure and simple.

I deem this approach to be unsatisfactory, as it encourages one to bypass the problem of FP stratification, rather than urging one to come to grips with it and find a resolution. I myself propose a three-level terminology that will let us discuss:

- *syntactic positions* of expressions, depending on their current syntactic function in a given compound – on level (FPa);[8]
- *semantic categories* of expressions – on level (FPb), and
- *ontological categories* of expressions' designates – on level (FPc).

[8] Cf. Ajdukiewicz (1979).

2.1.3 Preliminary Characteristic of FP Levels

To begin with, we need to consider the nature of the syntactic characteristic of an expression on each of the distinguished levels, and explore their various interrelations.

Let us begin with (FPc). A very general ontology that meets the requirements posed by Ajdukiewicz's last formulation of FP was given by Roman Suszko in his seminal paper (Suszko 1958 and 1960). Roughly, the construction starts from a sequence of sets (of individuals), called the fundamental sequence; the sets are fundamental ontological categories. Upon this sequence a hierarchy of higher order categories of functions is built up in such a way that functions with their domain in the Cartesian product of *n*-th order categories and value also in an *n*-th order category (or lower) belong to a category of the (*n*+1) order ('rank' – as Suszko calls it).[9] The FPc may now be reformulated as stating that if (at least one of the) arguments of a functor designate objects belonging to *n*-th order categories and the compound expression made up with the help of this functor designates an object belonging to maximally an *n*-th order category, then the functor itself designates an object belonging to a (*n*+1) order category (a relevant function).

Assuming such a kind of hierarchy of ontological categories has been standard for decades now, especially since Montague's *English as a Formal Language*, where a very similar (although noticeably less general) construction is given (Montague 1974b, pp. 192–193). Indeed, it is hardly conceivable to reject the assumption of having some sort of hierarchical ontology like Suszko's or Montague's when endorsing the FP; and I will not attempt it. I will however attempt to show – further in this chapter – that far more has been inferred from this assumption than the assumption can warrant, and that a common opinion about the relation between semantic categories of expressions and ontological categories of their designates has to be challenged.

Before that, however, let us turn to the levels (FPa) and (FPb). They were sharply contrasted by Ajdukiewicz (1978, p. 281 – note 2). When introducing the concept of the operator [(FPa) level], he explains its relation to the well-established concept of functor [(FPb) level] – which he himself made use of in Ajdukiewicz (1967) – as follows:

> The term 'functor' has two different meanings in the contexts: 'The expression f is a functor (simpliciter)', 'The expression f is a functor (performs the role of a functor) in the expression W'. In the contexts of the first type 'functor' is the name of an (absolute) property of some expression; while in the contexts of the second type it is the name of a relation between the particular expression and another one. ... To avoid this ambiguity ... I have introduced here the term 'operator' for those cases where we deal with the

[9] This is a somewhat simplified description; the full definition is quite complicated – cf. Suszko (1960, pp. 68–69) – and not as general: there are only three orders (ranks) of categories in the original text.

> syntactical function performed by an expression within another one. The term 'functor' may then be used as the name of an absolute property of some expressions. The term 'operator' is clearly syntactical, while the term 'functor' is […] a semantical one.

Accordingly, the FP on level (FPa) says that in a given compound expression we can distinguish precisely one part that would bind and unify the remaining parts into a single whole. We assign the syntactic position of operator to this part and the syntactic positions of its successive arguments (operanda) to the others. If any of the distinguished parts is still a compound expression, the above applies to it again. Syntactic analysis may thus have several so-called orders. For example, the expression 'John passionately loves Mary' is analyzed on level (FPa) as follows (Table 2.1.3.1):

Table 2.1.3.1 *Example 1*

	John	***passionately***	***loves***	***Mary***
1st order	**operandum$_1$**	**operator**		**operandum$_2$**
2nd order		**operator**	**operandum**	

In order to facilitate further analyses, it is worthwhile to adopt a more convenient notation of syntactic positions. One option is the Polish notation devised by Jan Łukasiewicz in the 1920s, which allows for encoding syntactic positions without brackets. In this notation, the operator is placed first and followed in proper succession by its operanda. If any of these parts is compound, the same convention applies within this part respectively. For example, the formula $(p \rightarrow q) \rightarrow (\sim q \rightarrow \sim p)$ of classical sentential calculus can be rewritten as CCpqCNqNp.[10] When we adapt this notation to categorial grammar, the above analyzed sentence will have the form 'Passionately loves John Mary'. This option was chosen by Ajdukiewicz in (1967). However, Polish notation has several drawbacks. Firstly, in order to state the syntactic position of any of the parts, one always has to state the respective syntactic positions of all the other parts of the analyzed expression, given that the position of each part is determined by its position relative to the others. Secondly, it is hard to indicate a syntactic position without referring to the expression under analysis or to the semantic category thereof. Something has to be inserted in a proper sequence – the word itself or its categorial index. Thirdly, as we will see below, there are such categorial grammars (not analyzed by Ajdukiewicz) that adopt more than one rule for multiplying-out categories. In such cases the Łukasiewiczian notation is ambiguous.[11]

[10] Such were the symbols originally devised by Łukasiewicz: 'C' stands for implication – 'consequence' – and 'N' for negation.

[11] For example in the grammar proposed by Geach – discussed further with more detail – there is a rule of functional composition, which allows a Łukasiewiczian string [s/s s/n n] to be categorized

The notation proposed by Ajdukiewicz in (1979) is free from these drawbacks. This convention requires the syntactic position of a given part to be represented as a sequence in which the final term is 0 for the operator or 1, 2, 3..., etc. for the successive operanda, while the preceding terms represent the syntactic position of the expression in which the mentioned operator and operanda are its immediate constituents. The syntactic position of the whole thus represented (the expression whose syntax we are attempting to determine) is 1. ‘John passionately loves Mary’ would thus have position (1), ‘John’ would have position (1, 1), ‘passionately loves’ – (1, 0), ‘Mary’ – (1, 2), ‘passionately’ (1, 0, 0), and ‘loves’ – (1, 0, 1). This notation makes it possible to indicate a specific syntactic position without indicating other positions – and even without indicating the word occupying this position or this word’s semantic category. It is also truly unambiguous.

The key to the entire structure is level (FPb). Sentence (1) is analyzed on this level as follows[12] (Table 2.1.3.2):

Table 2.1.3.2 *Example 1′*

	John	***passionately***	***loves***	***Mary***
1st order	|--*n*--|	|--------------*s/nn*----------|		|---*n*---|
2nd order	-	|(*s/nn*)/(*s/nn*)|	|*s/nn*|	-

The symbols ‘n’ and ‘s’ stand for the semantic categories of names and sentences respectively. Fractional symbols stand for functors: the numerator gives a semantic category of the compound expression in which the functor is the main operator, the denominator – the semantic categories of the arguments of the functor (operanda). For instance, *s/nn* is a two-place predicate that makes a sentence out of two names; *(s/nn)/(s/nn)* is a functor that makes a predicate out of a predicate.

We see that this level differs from the previous one in that the word ‘loves’ is of the same semantic category as the expression ‘loves passionately’, but that here it occupies a different syntactic position.[13] So wherein lies the specific nature of level (FPb)? What is the nature of this *absolute property of an expression* which makes an expression some particular kind of functor rather than another? What is a semantic category?

either as [s/s (s/n n)] or as [(s/s s/n) n]. Only the former categorization is allowed in the original grammar of Ajdukiewicz.

[12] I will be using the notation proposed in Ajdukiewicz (1967). Other authors subsequently improved it to better suit calculus purposes but I believe the original version remains the most legible one, best suited for the purposes of simple illustrations.

[13] Quite a similar bifurcation of the levels of syntactic description is visible even in traditional grammar, under the label of ‘parts of speech’ vs. ‘parts of sentence’ (cf. e.g. Chomsky 1965).

2.1.4 Definition of Semantic Category

Ajdukiewicz (1967, p. 223) gives the following definition:

> The word or expression A, taken in sense x, and the word or expression B, taken in sense y, belong to the same semantic category if and only if there is a sentence SA, in which A occurs with meaning x, and which has the property that if SA is transformed into SB upon replacing A by B (with meaning y), while retaining exactly the same meaning of the other words in sentence SA and the same syntax of this sentence, the resultant SB will also be a sentence.[14]

This definition was roundly – and rightly – criticized[15] on the grounds that its definiens features terms with unclear meaning and that any attempts to define these terms without contradicting our intuitions require references to the concept of – semantic category. The definition of semantic category is thus in danger of falling victim to the vicious circle. The problematic expressions in the quoted definition are 'sentence' and 'syntax'.

Sentences, let us note, form one of the semantic categories. To say that a given expression is or is not a sentence is to assign it to a particular category. Accordingly, before we introduce our definition, we must define the concept of semantic category – or at least come up with a partial definition pertaining to sentences.

Some authors attempt to bypass this problem and modify Ajdukiewicz's definition by replacing the concept of sentence with that of meaningful expression. This way out, in tune with obvious intuitions, is considered by, among others, Jadacki (2003). However, such an approach merely serves to pick up the problem and deposit it elsewhere. A meaningful (or syntactically coherent) expression is defined as one *constructed in keeping with syntactic rules* or quite simply as one in which the functor and its arguments are properly distinguished (cf. Ajdukiewicz's earlier FP wording quoted above). The latter formula refers directly to the concept of semantic category (functor), thereby presupposing its definition, while the description of a meaningful expression as one that is constructed in keeping with syntactic rules faces us with the problem of defining syntax, a concept that is explicitly referred to in it. The vicious circle looms again, unfortunately. In categorial grammar syntactic rules describe correct relations – between functors and their arguments. We cannot define semantic categories in terms of syntax, or syntax in terms of categories. Ajdukiewicz's definition is clearly unacceptable.

This is not to say, of course, that a semantic category cannot be correctly defined at all. For instance, we could resort to some form of denotative definition and simply enumerate expressions belonging to the various categories, with this definition assuming, in particular, the form of recursive definition (cf. e.g. Montague

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[14] I have revised the English translation of this passage to make it closer to the original wording .

[15] Cf. e.g. Jadacki (2003).

1974a). A characteristic of this kind is already the norm in contemporary treatments of a more formal nature (cf. *e.g.* Oehrle et al. 1988).

A denotative definition does have its drawbacks, though. For one thing, there is the problem of compatibility of the classes defined by enumeration with the original intuitions with regard to the given concept. Another problem is the material effectiveness of this enumeration, in other words the problem of indicating a procedure for an actual (as opposed to 'mental' or by assumption) inclusion of every expression in an appropriate semantic category.

There is no need, however, to attempt to formulate a normal definition that precisely and intuitively characterizes the concept of semantic category. This can be done with, for example, a *definition through postulates* that formulate theses about categories, expressing various aspects of relevant intuitions. Needless to say, such theses (treated as postulates) not only can but indeed have to contain the term 'semantic category', and are not subject to the vicious circle restriction.

We will now examine the most important of these theses. They are not new in any way, which is not surprising, given that they are meant to express basic intuitions. In fact, most of them have already been formulated in one way or another in Ajdukiewicz's classical works and have subsequently appeared in works by most other authors writing on the subject. However, their postulative nature was not always acknowledged (particularly not by Ajdukiewicz) and the tendency was to treat them as more or less direct consequences of some separately proposed definition of semantic category. (As we have seen, such a definition – or at least a definition of the type proposed by Ajdukiewicz – leads to all manner of major problems.) It will soon become clear that our postulates reveal serious controversies underlying the basic tenets of categorial grammar. An examination of these controversies prompts a number of fundamental questions.

2.2 Fundamental Intuitons: Postulates and Controversies

2.2.1 Interchangeability Principle

If two expressions are mutually interchangeable in a sentence (or in any meaningful expression) without damage to the *propositional character* (meaningfulness) of this sentence (or expression), then they should be included in the same category. This principle, although quite unacceptable as a definition (as we have seen), is a very convenient sufficient condition for '*being of the same category as*', and this is because it is a natural expression of perhaps the most powerful intuition: that if the replacement of one expression with another in a compound expression does nothing to reduce the meaningfulness of the latter, and since the

meaningfulness of a compound expression depends on the configuration of syntactic roles, then the expressions in question have to be performing the same syntactic role; this in turn has to mean that they belong to the same semantic category.

This principle, as originally formulated by Ajdukiewicz, is exposed to charges of possible inadequacy both as a sufficient and necessary condition. Let us examine those charges in detail.

Sufficient condition. The principle speaks of *some specific sentence* in which substitution takes place, whereas the intuition underlying the principle clearly has to do with interchangeability in *any sentence* (resp. meaningful expression). On the one hand, this principle obviously cannot refer explicitly to interchangeability in every context, as this would make it radically ineffective: one would have to consider all sentences (resp. meaningful expressions) to ascertain whether two expressions are of the same category or not. On the other hand, one cannot *a priori* rule out a situation whereby, in a specific sentence, some part is substituted by another which we intuitively assign to a different category (without altering the meaning of the remaining words or the syntax of the entire expression) while the sentence so modified remains a sentence. In such a case the considered principle would be inadequate as a sufficient condition for belonging to the same category.

Nonetheless, I believe demonstrating such a case is no easy feat. In fact, I am tempted to believe that two sentences differing *only* in the category of one of their parts have to differ in some other way as well, at least in the syntactic positions of certain other parts. Let us consider a few examples (Tables 2.2.1.1 and 2.2.1.2).

Table 2.2.1.1 *Example 2*

John	***and***	***Mary***	***said***	***'hello'***
	n		*s/nn*	*n*
n	*n/nn*	*n*		

Table 2.2.1.2 *Example 2′*

John	***came***	***and***	***Mary***	***said***	***'hello'***
s		*s/ss*		*s*	
n	*s/n*		*n*	*s/nn*	*n*

In the Example 2 name 'John' was replaced with the sentence 'John came' and the resultant sentence remained meaningful. However, this is not a counterexample, since before the substitution the functor 'and' is a nominal conjunction (*n/nn*), and after the substitution it becomes a sentence conjunction (*s/ss*). This

example fails to meet the requirement that no parts other than the substituted ones can have their meaning or syntax changed in any way.

The following example seems more to the point (Tables 2.2.1.3 and 2.2.1.4):

Table 2.2.1.3 *Example 3*

My	*justified*	*opinion*	*was*	*rejected*
	n		*s/nn*	*n*
n/n	*n*			
	n/n	*n*		

Table 2.2.1.4 *Example 3′*

Well	*justified*	*opinion*	*was*	*rejected*
	n		*s/nn*	*n*
n/n		*n*		
(*n/n*)/(*n/n*)	*n/n*			

Here, the replacement of 'my' (*n/n*) with 'a well' (*n/n//n/n*) does not affect the semantic category of any of the other parts. So could this be the counterexample we are looking for? Well, no, because the syntax of the expression did not remain unchanged following the substitution: the *syntactic position* of the word 'justified' is different in the new expression. Let us analyze the syntactic positions in both of the above cases (Tables 2.2.1.5 and 2.2.1.6):

Table 2.2.1.5 *Example 4*

My	*justified*	*opinion*	*was*	*rejected*
	(1,1)		**(1,0)**	**(1,2)**
(1,1,0)	**(1,1,1)**			
	(1,1,1,0)	**(1,1,1,1)**		

Table 2.2.1.6 *Example 4′*

Well	*justified*	*opinion*	*was*	*rejected*
	(1,1)		**(1,0)**	**(1,2)**
(1,1,0)		**(1,1,1)**		
(1,1,0,0)	**(1,1,0,1)**			

In the former case, the position of 'justified' is (1,1,1,0) – and it is the operator in the first argument of the first argument of the initial expression – whereas in the latter case its position is (1,1,0,1) – that of the first argument in the operator of the first argument of the initial expression.

It appears that substitutions of expressions belonging to different categories will always result in at least the kind of differences shown above.[16] Until someone shows a real counterexample, it is rational then to maintain the Interchangeability Principle as a sufficient condition for belonging to the same semantic category. And it is very useful – the principle is a very valuable analytical tool, in many cases making it possible to parse given expressions and to assign proper categorization to the resulting parts. Namely, this principle allows us to add new expressions to a given category. If, for example, an expression w_2, belonging to an unknown category, can replace an expression w_1 (of a known category) within a sentence z_1, so that the resulting compound z_2 remains a sentence, then it can be inferred that w_2 belongs to the same category as w_1. Such a procedure becomes easier and easier when iterated: there are more and more expressions that can play the roles of z_1, z_2 and w_1. The usefulness of this procedure is perhaps best visible in the case of assigning categories to very compound expressions: it makes it possible without the parsing of these expressions – on the grounds of interchangeability with some simple expressions.

Necessary condition. The perspectives of the opposite relation – interchangeability as a necessary condition – look worse at first glance.

Consider for example sentences like 'Green colorless ideas sleep furiously' (a well known example of Chomsky's). Such sentences are judged unacceptable by most speakers; incorrect in some aspect. Senseless – in some sense of 'sense'. Meanwhile syntactically analogous sentences – at least superficially – like: 'Green fried tomatoes sizzle loudly', are totally natural, well formed and fully acceptable. Therefore at least some of the expressions: 'colorless' and 'fried', 'ideas' and 'tomatoes', 'sleep' and 'sizzle', 'furiously' and 'loudly' – that is expressions belonging (pairwise) to the same categories – are not interchangeable with their mates *salve* acceptability. Such examples can be countless. This is definitely not a margin that could be ignored ; it is rather something very common.

Generally speaking, there are three possible reactions to this problem.

Firstly, we can concede that interchangeability just isn't a necessary condition for belonging to the same semantic category, i.e. that there are expressions that belong to the same category, yet are not interchangeable (not in any context).

Secondly, we may choose to maintain that the words in the above listed pairs do not belong to the same categories. In such a case, having in mind that these words belong to the same Ajdukiewiczian categories (let us call them standard semantic

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[16] The idea of answering the objections to interchangeability along the lines drawn above (with the help of the analysis of the syntactic positions, which supplements the analysis of the semantic categories) was proposed already by Henryk Hiż (1960) – his 'grouping' means the same as our 'syntactic position'.

categories), we are facing an emerging need for some new, vastly more detailed and complicated system of (sub)categories[17], designed to match the requirements of the concrete, traditional grammar of a given language.

Thirdly, we can reassess and modify the intuitions concerning the notion of meaningfulness, embedded in the wording of the Functioriality Principle. In particular we can separate the notion of meaningfulness from the notion of acceptability or traditional grammaticality and provide the former with a technical, intra-theoretical meaning. To avoid confusion we may use a new term, forged for this purpose by Ajdukiewicz and Geach: ‘syntactic coherence’ (SC). A sentence like ‘Green colorless ideas sleep furiously’ would be evaluated as syntactically coherent (in contrary to, say, ‘Franchise albeit said have ever John must’), though perhaps unacceptable for some extra-syntactic reason.[18]

The first reaction does not seem plausible. For one thing, it goes against the very idea of a potential syntactic role, which founds the notion of semantic category. What would be the point of such a role if expressions that belong to the same semantic category could not be interchangeable? Categorization would be pointless; every expression would have to be considered – as to its syntactic properties – individually. Another issue is productivity: normally we understand that we can produce a new expression, never heard of before, by interchanging words or phrases in a well known syntactic structure.

Therefore, similarly as before, when we considered the Interchangeability Principle as a sufficient condition for belonging to the same semantic category, I would recommend preserving the principle. With both aspects joined – as a condition sufficient and necessary – IP constitutes one of the fundaments of the categorial theory of syntax.[19]

A real dilemma occurs in choosing between the second and third option. The prices for each of them are quite high, although it is difficult to measure them in one currency. Preference would therefore depend much on the exchange rate or – without metaphors – on the aim and perspective of the theory of syntax we are about to conceive. From the perspective of a traditional grammarian, who aims at cataloguing the rules of his or someone else’s language, perhaps the second option is the right choice. In a philosophical, epistemological perspective, when we aim

[17] Systematically speaking, such new groups of expressions are just categories – *whole* categories, so to speak. It is they that are mentioned in the interchangeability principle and in categorial grammar in general. However, in most literature such particular groups are usually called ‘subcategories’ and I will conform to this custom.

[18] There is a variant of the third option according to which we should rather re-examine the intuition of acceptability: ‘There are no such things as uninterpretable, syntactically well-formed sentences. To our minds the *sentence Colourless green ideas sleep furiously*, that Chomsky […] claimed proved the autonomy of syntax, only proves that people assign an interpretation to almost any syntactically well–formed sentence – and that they have a very flexible imagination’(Mineur, Buitelaar 1996, p. 126).

[19] As Jean Aitchison argues, the intuition of interchangeability might be an overall human cognitive adaptation, attuned for linguistic purposes (Aitchison 2000).

at explaining syntax in general, it is better to spend more on the third one. This choice is *de facto* a choice of a methodological perspective; a decision on how extensively we are going to rely on the *raw empirical facts* of linguistics, on the '*yes – yes'* or '*no – no*' of our informants. We have already made our choice in the Introduction to the present book – it is the postulate of the methodological autonomy of syntax. Let us here discuss it a bit more.

The idea of detailed subcategorization, aiming at making syntactic theory empirically adequate (by conformity with acceptability judgments), emerges as an element of the generative program (entertained mainly by those authors who stressed the semantic aspect of generative grammar). It was introduced in the work (Katz and Postal 1964) in the guise of the structure of the lexical item:

> The meaning of a lexical item [or a dictionary entry] – according to Katz and Postal (1964, p. 14) – is not an undifferentiated whole. Rather, it is analyzable into atomic conceptual elements related to each other in certain ways. Semantic markers and distinguishers are intended as the symbolic devices which represent the atomic concepts out of which the sense of a lexical item is synthesized.

The authors give 'Human', 'Animal', 'Male', 'Female', 'Adult', 'Young', 'Never-married', 'Knight'; 'Evaluative', 'Moral'; 'Animate', 'Higher Animal', 'Physical Object' and so on as examples of atomic concepts. Subcategorization in this case means that certain sets of atomic concepts, regarded as the markers for selection or restriction rules, constitute the classes of expressions having common selection restrictions, such that specific syntactic rules can be formulated for them (which amounts to saying that they play the role of semantic subcategories). From our perspective this doctrine encounters serious obstacles – even if we agreed that whether an expression belonged to a certain subcategory or not was indeed decided in a dictionary (which would make the dictionary one of the components of syntax).

Firstly, it is not clear which atomic concepts from the definition of a given lexical item convey its subcategory – what is the subcategory of e.g. bachelor: 'Object', 'Physical Object', 'Animate', 'Human', 'Adult', 'Male', 'Never-married'*?* Secondly, different syntactic rules may engage differently specified subcategories: for some rules being an *Object* is enough, some others would require, say, *Artefact*. Thirdly, the rules are subject to countless exceptions. *Deviant* expressions in one context would appear completely natural in another, as easy to decode metaphors. Metaphors in turn are literally false (they require some meaning-shift in order to be true); if so – they cannot be nonsenses.

Moreover, it seems that even if we somehow managed to overcome these obstacles, we would get something very artificial anyway, far beyond any natural intuition of sense and absurdity. The thing is that agreement about the lexical source of subcategorization should be withdrawn: whether an expression belongs to a certain subcategory or not is rather an empirical matter of facts than conventional matter of lexicon entries. A proper classification of a word often depends on our knowledge about this word's designates: what they are, what their properties are,

etc. If subcategorization were to decide about grammaticality, then grammaticality would depend on material knowledge from countless fields of life and numerous disciplines of science. For instance, an idea cannot be impermeable. Agreed. What about a physical object? Any object? Is the Sun impermeable? (Surely it is not permeable, but is it impermeable?) Or the Earth? What about earth? Rocks, geological layers... From some point on the answers become dependent on empirical research.

Subcategorization sometimes also depends on some conventional, but not exactly linguistic decisions (it is the case, i.e., when naturally vague expressions are conventionally made precise). In Polish, for example, there are different grammatical forms of verbs attached to personal and impersonal plural nouns. But what counts for a personal noun? What is a person? Men are persons; apes are not. But ape-men? Linguistic *usus* in Polish is such that Neanderthals are human enough and 'Neanderthal' is a personal noun; whereas Australopitheci are not and 'Australopithecus' is not personal. However, if someone uses the word 'Neanderthal' in an impersonal form and accompanies it with the impersonal form of a verb it can be regarded by the audience either as slightly ungrammatical, or as perfectly grammatical, but just somewhat contemptuous of Neanderthals.

Even mathematics can be the criterion here. Let us look at Paul Ziff's example:

> Consider the environment 'The person of the sex opposite to his at that time since when he has changed sex seven times, that person hurt …. +self': what fills the blank, 'him' or 'her'? Assuming that elementary arithmetic is not a part of a grammar, this is not a grammatical question. [20]

Thus, if we were about to match our categorization with the sense of naturalness or acceptability, we would need a great number of subcategories, 'about 7023', as Ziff ironically estimated. They would differ in utility (or *ad-hocness*), as he rightly pointed out,[21] they would differ also in their source: empirical, conventional or even arithmetical, as we may add here. Subcategorization is mostly a semantic and pragmatic matter: it is a linguistically encoded cognitive classification of objects. As there are grammatical rules depending upon such a classification, we can call it a grammaticalized knowledge, we shall understand, however, that such rules, being grammatical in a traditional sense, cannot belong to a logical theory of syntax.

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[20] Cf. Ziff (1964, p. 213).

[21] Ziff's account, based upon the pragmatic notions of utility and ad-hocness, is much more to the point than Chomsky's remarks on the subject of subcategorization, scattered in his early works (e.g. 1961, 1965). Chomsky insisted that degrees of grammaticalness of expressions – as he called it – depend upon the generality of the allegedly violated rules (the more general the rule, the less grammatical a sentence results in violating it). As Schütze points out, Chomsky's proposal, which heavily rests upon the assumption that there are in fact distinctions in ungrammaticality, but not in grammaticality (which is absolute), hardly finds any support in psychological evidence (Schütze 1996, p. 66). Linguistic evidence also hardly supports it. The results of the experiments have often been contradictory and many of them showed different patterns of acceptability than predicted (ibidem, pp. 70n).

A still further argument goes from the observation of how vastly the rules differ from language to language. Whereas subcategorizations themselves are relatively similar in different languages – this, again, speaks for their semantic character, because their relative uniformity can be accounted for in terms of the relative uniformity of rudimentary classification of the world in different linguistic communities[22] – the rules connected with them are highly divergent. To give just a few examples: in Polish every noun belongs to one of three genders (*masculinum, femininum, neutrum*); in English only personal nouns do (with the exception of personificated pets or ships). In Polish we can use the same quantity words 'dużo' and 'mało' for countable nouns and mass nouns: 'dużo' = *many* or *much*; 'mało' = *few* or *little*; in English 'few' and 'little' or 'many' and 'much' respectively are strictly separated. In Polish there are different forms of plural verbs following personal and impersonal nouns, as mentioned above, in English there is no such distinction. And so on, and so on.[23]

To sum up, if we want to keep syntax pure and simple and free from the peculiarities of any particular dialect or idiolect, we shall avoid subcategorization in syntax, and choose the third option: considering only such expressions that are wrongly arranged in terms of the 'big', Ajdukiewiczian categories (names, sentences, and a hierarchy of functors), such as 'beware all would the before Anselm been to close' ungrammatical (or better: syntactically incoherent). If an expression is syntactically coherent, then even if it is hardly acceptable, we will regard is as grammatical and seek for the reason of its unacceptability in some semantic or pragmatic aspect of the case. Not every absurdity is a syntactic one and not every ungrammaticality in the traditional sense violates the logic of the language.[24]

Some complication to the picture that emerges from the third option may be introduced by the observation that names, for example, can be classified not only by the properties of their designates, but also by some logical properties of their meanings. The most influential division here is probably the division of names into proper names and descriptions (or in the Millian tradition: individual names and general names). Many theories of syntax would mirror this division by introducing two name-like categories, for instance Proper Names and Common Nouns, or something like this. Such a tendency is not restricted to the generative tradition,

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[22] Despite the claim of radical relativists, most people have quite a similar picture of the world, I believe.

[23] This observation supports what we have assumed about the roles of grammatical rules in the Introduction. The distribution of words is supposed to teach us about meanings and facts. To achieve this goal we require that rules and distribution patterns together would yield a certain subcategorization, but no particular rule or pattern is important by itself. Having different rules, languages have different distribution patterns.

[24] The third option, although alien to generative tradition, has already been strongly supported in literature – for instance by Quine: '*Quadruplicity drinks procrastination* and *This stone is thinking about Vienna*; an illustration, namely, of how grammatical simplicity can be gained by taking grammaticality broadly (Quine, 1970, p. 101). In recent literature see e.g. Camp (2004).

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on the contrary, some systems of categorial grammar (or akin, like Montague Grammar) would also include these two categories of names.[25]

Nevertheless I consider the arguments against such a bifurcation of the category of names at least as strong, if not much more convincing. In fact, the only obstacle to having just one category of names is that descriptions are supposed to serve predication (and thus to have meaning), whereas proper names are banned from such a purpose and intended to serve as linguistic representations of some given, concrete objects (regardless the meaning, whether they have it at all, or not); so the former are suited for predicates (or parts thereof), whereas the latter are rather the subjects of sentences.

Indeed, it is hard to deny that such a dichotomy of semantic functions exists. However, it is not so clear whether it can be approximated by a dichotomy of syntactically defined word-classes. On the contrary, much of the work in the philosophy of language for the last forty years has suggested that the same kinds of expressions can serve both purposes, depending on the occasion. Keith Donellan (1997) stressed the possibility that descriptions are used referentially to pick out given objects; proper names – on the other hand – can be used connotatively, at least on occasion. It is debatable whether proper names in general have meanings or not (cf. well-known discussion in Kripke's *Naming and necessity*[26]), but it is obvious that proper names can at least sometimes be used as shortcuts for some cluster of descriptions (Searle 1958) or be burdened with the connotation of the property that such-and-such object was named so-and-so (Burge 1973). Furthermore, as people usually give names according to some system of nomenclature, one or another, a proper name can also reveal its bearer's place in such a system (and upon this capability serve for predication about the bearer) – this option is mentioned in (Barwise and Perry 1983).

Summing up, I do not see any overwhelming reason for abandoning the original idea of one syntactic category of names (whose further subdivisions have little impact on general syntax). Some challenge could perhaps have come from the problem of quantification, but to my knowledge it didn't - the whole problem of quantification will be discussed later, in Chapter 4.

2.2.2 Division into Basic and Non-basic Categories

Two groups are universally distinguished in the multitude of diverse semantic categories, namely basic categories and functor categories.[27] Ajdukiewicz included

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[25] Ajdukiewicz himself tentatively entertained such an idea (Ajdukiewicz 1967).

[26] Kripke (1977).

[27] In English-language literature we sometimes encounter the terms 'primitive categories' and 'derived categories'; cf. e.g. Bach (1988). This terminological convention, although embraced less frequently, appears to better reflect the intuitions underlying the discussed division.

the category of names (which we shall denote by *n*) and the category of sentences (*s)* in the former. He also speculated about introducing additional categories by subdividing the category of names – see above – but never got around to actually proposing any. More recent authors did not always respect this two-category limitation (cf. e.g. Casadio 1988).

It appears that the controversy over the number of basic categories – whether there should be two of them, or more, or fewer – touches upon the basic intuitions underlying categorial grammar, namely the *fundamentum divisionis* of categories into the basic and non-basic. It is assumed that basic categories include expressions with a meaning of their own, in themselves constituting units of meaning. These are contrasted with functor expressions which, as Ajdukiewicz put it, are 'unsaturated' signs with 'brackets following them' (which is, of course, a Fregean idea of concept[28]). Basic categories represent the basic semantic function of an expression: reference to an extra-linguistic reality. The problem lies in identifying the manner in which this reference takes place.

One possibility here is to heed traditional grammar and empirical rules of acceptance of sentences in a concrete language given by informants speaking that language. In this case, the categorial system would serve to model interchangeability while strictly respecting grammatical correctness in the sense of the grammar of a given language. Obviously, in this situation we would have to distinguish numerous basic categories, since we have numerous grammatical subcategories of names and sentences. For example, we would have to distinguish between proper names and noun phrases (as in Montague 1974a). And not only that. We also have countable and mass names; masculine, feminine and neuter names; generic (or collective) and distributive names. All of these names somehow affect the conditions of proper use and interchangeability in terms of grammatical correctness (in the linguistic sense). Likewise, different kinds of sentences may be subject to various grammatical restrictions, e.g. word order reversal in subordinate clauses, or scrambling in the German and Dutch languages. Tense and aspect are an entire world of rules and restrictions about sentences.[29]

However, reference to extra-linguistic reality is assuming a very particular character here, relativized to traditional grammars of specific languages. If we also consider that the informants' intuitions regarding the acceptability of specific linguistic structures are as a rule not purely syntactical, we may discover that relativization reaches down to the level of discourse or even a single context. As we have discussed before, detailed subcategorization is not a plausible option for us. We should find something else for distinguishing the modes of reference.

Indeed, we can find a relevant base for the discussed distinction in one of the most profound features of language, stressed and analyzed at the very dawn of contemporary philosophy of language itself: the language's intentionality.

[28] Frege (1980a).

[29] Cf. e.g. Labenz (2004).

The notion of intentionality, stemming from the work of Franz Brentano, was spread mainly by two of his pupils: Kazimierz Twardowski (1977) and Edmund Husserl (2001). Twardowski, the founder of the Lvov-Warsaw School, established the general notion of intentionality as one of the elements of the common background in Polish philosophy of the first half of the twentieth century. Ajdukiewicz (incidentally a son-in-law of Twardowski), as well as many other prominent members of the School, could have adopted this notion almost automatically. However, had he needed some reinforcement and refinement or more explicit formulation, he would have found it in the works of Husserl, whom he declared on many occasions one of the most influential sources of intuitions for his categorial grammar.

The notion of intentionality, although elaborated on thoroughly in *Logical Investigations*[30] and in some later works of Husserl, is not very simple, and is quite susceptible to misinterpretations. The term itself sounds ordinary and familiar but this may be delusive. Husserl took it from the Latin verb 'intendere' which means roughly 'to point to something' or 'to be directed to something'. Intentionality is the 'directedness' of consciousness or language. That is a very important point. One cannot stress too strongly the fact that intentionality has nothing to do with *intentions* normally understood as one's wishes or plans.[31] Intentionality is directedness. It is a transcendental – to use a Kantian term – capacity of a subject to grasp a transcendent object. Whenever we think – or speak – *of* something, our thoughts and expressions are intentional, *viz*. directed to this something, regardless our plans, wishes and intentions. Sometimes, of course, our intentions, understood as plans and wishes, do matter in linguistic behavior: they are the subject matter of pragmatics (e.g. implicature) – Husserl acknowledges this *e.g.* in Investigation I, par. 7, where he speaks of the communicative function of language. But they have nothing to do with the descriptive function. Our thoughts and the expressions of our language[32] are intentional by their very nature, whether we want this or not. Everything that refers to something is intentional. One might say that intentionality understood in such a way is an explication (in a somewhat Kantian spirit) of how the notorious relation of correspondence between mind or language and world is possible. It is intentionality – 'directedness' – that enables semantics.

> Linguistic reference in general, according to Husserl, is itself a species of intention, or direction toward an object. Thus, theory of reference, and semantic theory generally (in

[30] Husserl (2001).

[31] The modern word 'intention' certainly derives from the same Latin verb – but it is a sort of lexicalized metaphor: when we wish something or plan to do something, we are in a sense directed toward this something; the literal meanings of ordinary 'intention' and original 'intendere' (and thus technical 'intentionality') have diverged.

[32] The parallel between the two is almost perfect: according to Husserl and virtually all his commentators language is an expression of thought; the intentionality of acts of consciousness is reflected by the intentionality of language; language without intentionality is a mere collection of sounds or drawings.

the tradition of Frege), turn out to be subparts of Husserl's theory of intentionality (Smith and McIntyre 1982, pp. 34–35).[33]

Now, what is relevant for our purpose of establishing the basic semantic categories of expressions is that according to Husserl there are *two kinds of intentional acts*: nominal acts (of referring to something) and propositional acts (of asserting something). Cf. Husserl 2001, Investigation V, Paragraphs 28–36, for instance:

> No one would question that, for every judgement […] there is a presentation endowed with the same matter and therefore presenting the same thing in exactly the same manner, as the judgement judges about it. To the judgement, e.g. *The earth's mass is about 1/325,000 of the sun's mass*, corresponds, as 'mere' presentation, the act performed by someone who hears and understands this statement, but sees no reason to pronounce any judgement upon it. We now ask ourselves: Is this very act of mere presentation a constituent of the judgement, and does the latter merely differ in respect of a superadded, deciding note of judgement which *supervenes* upon the mere presentation? I for my part, try as I may, can find no confirmation of this view in descriptive analysis. I can find no trace of the required duplicity in act-quality (vol. II, pp. 139–140). Closer consideration rather proves that […] [t]here are different modes of intentional reference to one and the same object of which we are in an identical sense 'conscious', and this means that we have *two acts similar in matter but differing in quality*. One of them is not, as a real part, enclosed in the other, in the sense merely that, in the latter, a new qualification has been added to it (vol. II, p. 144).[34]

[33] Smith and McIntyre's book is known as one of the most authoritative books on Husserl and intentionality written from the perspective of contemporary philosophy of language. Not the least important virtue of this book is the very fact of reestablishing Husserl as one of the founders of contemporary analytic philosophy, side by side with Frege (Husserl's importance for analytic philosophy has long been neglected due to his esoteric phenomenology of late writings, thanks to which, on turn, he became one of the most prominent persons in the continental tradition, especially existentialism). It is a pity that the authors contaminate such pure and right statements as cited above in the main text with passages like this: 'The distinction between and extensional sentences comes close to being linguistic counterpart of Brentano's and Husserl's distinction between intentional and non-intentional phenomena.' (p. 24), which is close to contradictory with the former one. In fact all expressions – extensional as well as intensional ones – are intentional in Husserl's sense. The linguistic counterpart of my act of consciousness of judging that in the room there is the murderer is an extensional sentence 'The murderer is in this room' not intensional 'I judge that the murderer is in this room'. The latter is the counterpart of a higher level act of self awareness, when I think about the fact that I judge that the murderer is in this room – and perhaps that my judgment is irrational, for instance (Smith and McIntyre, again rightly, make a remark of this sort on p. 186).

[34] Smith and McIntyre are ambiguous here: in one place they notice Husserl's stance (although massively underestimate its importance calling this fundamental distinction 'simply different modes of intending the very same object' (p. 9)) in another place however (p. 6) they seem to maintain that nominal acts and propositional acts are distinguished by their objects (with contradicts explicitly the passage just cited from Husserl in the main text). They illustrate the distinction of nominal acts (they call them 'direct-object-acts') and propositional acts by contrasting sentences like *Smith remembers Bertrand Russell* vs *Smith remembers that Bertrand Russell was*

The categories corresponding to those two kinds of acts are, of course, those of names and sentences. We assume that each basic syntactic category corresponds to a single *kind* of intentional act. There is no difference needed in referents of the expressions of the respective category. Of course sentences cannot refer to things; but names can very easily refer to states of affairs or to truth values ('state of affairs' and 'truth value' are good examples). The distinction turns out to be as basic and primitive as possible, and neither category is more basic or more primitive than the other; both are equally essential features of language. Everything else is not so basic and every conceivable further subcategorization is secondary – compared to this one.

This Husserlian paradigm boasts a grand and long – and clearly universalistic – tradition, going back all the way to Aristotle and his division of expressions into *onomata* and *rhemata*.[35] In fact the very natural assumption made in most linguistic enterprises that, out of the parts of speech, two are the most fundamental: the noun and the verb[36] – can be also associated with a similar intuition, which seems to prevail in reflection on language through the ages. Bach (1988, p. 25) puts this in more general terms, claiming that categories are part of the innate human cognitive mechanism.[37]

To sum up: each compound must be divided into an unsaturated concept-functor and its object-arguments that have a meaning of their own (Frege), and all

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imprisoned (p. 7), whereas the proper illustration would be rather: *Bertrand Russell* vs *Bertrand Russell was imprisoned*. Compare the previous footnote.

[35] A reversion of Aristotelian and mediaeval traditions is advocated by Geach (e.g. 1979). It would perhaps be interesting to know that this article was written originally in Polish (and only afterwards rewritten by the author in his mother-tongue).

[36] Of course if we want to interpret the fundamentality of nouns and verbs in Husserl's vein, we cannot accept a conception in which 'a noun, for instance, is claimed to instantiate the schema [[THING]/[X]], and a verb the schema [[PROCESS]/[Y]]…' (Langacker 1991, p. 17). The distinction has nothing to do with things and processes. Besides, it is perhaps worth a separate remark that verbs in the Husserlian perspective are rather metonymies of sentences (of which they are *sine qua non* parts) than actual 'unsaturated' functors. Categorial Grammar slightly modifies traditional intuition to make it precise (and to accommodate Frege's idea of functoriality).

[37] Both the original Husserlian and the modern cognitivistic stance assume that basic semantic categories are innate. Models of the evolution of syntactic communication are discussed in Nowak et al. 2000. It is perhaps worth mentioning that innateness does not mean that the number is universal and *necessarily* the same for all human languages and populations (although probably it is the same *de facto*). Not everything that is innate is universal. This particular question may depend on whether language evolved once in a human population, or perhaps two or more times. Some researchers assume that fully-blown language emerged around 35 thousand years ago (along with the rise of the Cro-Magnon culture); whereas the migration of *homo sapiens sapiens* from the African cradle to Europe, Asia and Australia is dated around 100-50 thousand years ago (Leakey 1994, Diamond 1992, differently – Aitchison 2000). Such a timing would allow for a multi-centered evolution of language. However, to my knowledge, nothing so far suggests that language really evolved many times rather than just once. Note: this question must be clearly distinguished from the hypothesis of a multi-centered evolution of mankind. That is a separate issue.

expressions that have a meaning of their own are either names or sentences (Husserl). These are the foundational ideas of categorial grammar.

In theory, we have yet another option. Proponents of the formalistic approach (cf. e.g. Buszkowski et al. 1987) do not consider the manner of reference a problem at all. Their only concern is the number of basic categories needed to formally initiate a recursive, denotative definition of semantic category. This number is usually one, and the sole basic category that is assumed is that of sentences.[38] Quite recently the discussion about such an attitude was revived due to the publication of (Carstairs-McCarthy 1999), where the idea of a Monocategorial language is entertained. The possibility of such a language is further commented on by Barbara H. Partee (2006). Partee sympathizes with this possibility and discusses some theoretical tools that she would find helpful to formally establish such a language – a wide range of different theories of various sorts – but all this in a very tentative manner. She finds the motive for ever trying such a move in that she cannot see any reason, important enough, for having two basic types, so why shouldn't we have just one. As she puts it – we have two basic semantic types 'in part because of tradition and in part because doing so has worked well' (p. 1). The spirit of the paper is perhaps best breathable in the concluding questions: 'So why not? Are we just following tradition or is there a deeper reason to build a semantics on two basic types rather than just one?' (p. 3). In my opinion the Husserlian account of intentionality we have just called for constitutes such a 'deeper reason'.

Anyway, as Bach (1988) points out, in order for a simple sentence to have any internal structure at all, we need functor categories which, together with sentences, would allow us to introduce the category of names. This latter category would now be a derived category – but derived in quite a different sense. In the formalistic approach we have to do with a completely different concept of 'primitiveness' than in the approaches discussed previously.

2.2.3 Syntax-Semantics Interface

Another postulate, which conveys some basic intuitions about the Functoriality Principle, can be formulated as saying that categorial grammar should establish a close connection between the syntax and semantics of a language: syntax and semantics are meant to be somehow unified within this framework. This intuition is expressed very openly and commonly in the literature. To give a few examples: a survey article of Claudia Casadio (1988) begins with the sentence: 'A main claim about Categorial Grammars is that they involve *semantic categories* rather than the standard syntactic categories employed in linguistic description'. Bach (1987, p. 251) writes that 'a fundamental property of categorial systems is that they

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[38] Although e.g. Hiż (1960) claims that the minimal number of categories required for proper definitions is four (*s, n, s/nn, s/ss*).

encode at one and the same time an assignment of expressions to syntactic *and* semantic categories.' Michael Moortgat (1997, p. 98) in a *quasi*-encyclopaedic article, very decidedly states that 'a key point of the categorial approach is that one can simultaneously consider the types/categories, and hence grammatical composition, in the *meaning* dimension [...]. Composition of linguistic form and meaning composition thus become aspects of one and the same process of grammatical inference.' Similarly Bob Carpenter (1997, p. XV): 'The primary reason for the choice [of a type-logical categorial grammar as our grammatical basis] is that I believe that syntax and semantics are closely related aspects of the same issue'.

Unfortunately, this postulate is less specific than it should be desired. In the Montagovian tradition this postulate is relatively well-defined under the heading of the so-called *rule-to-rule correspondence* (for non-algebraic accounts) or *homomorphism requirement* (for these accounts where the systems of syntax and semantics are given the formal shape of algebra).[39] But even here misunderstandings and doubts are difficult to get rid of, because it is not entirely clear what counts for a rule and what does not. Some tend to think, for instance, that this *rule-to-rule correspondence* works analogously to, say, a *mouse-to-cursor correspondence*: the movements of the mouse on the table correspond to the movements of the cursor on the screen. This metaphor brings a substantial topological consequence: a closed curve drawn by the mouse is paired with a closed curve on the screen. If such a picture were transferred to the syntax-semantics interface, it would mean that only fully (disambiguated) languages can be properly described – since such an interpretation rules out the possibility of amphibolies. Syntactic ambiguity means that from the same set of words the same compound expression is built via different sets of syntactic operations. (Different respective meanings can be associated with these different sets of syntactic operations (i.e. with the way in which the expression is structured). However, we are still dealing with *one* expression (an ambiguous one but still one). It means that all the (different) sets of syntactic operations lead to the same result (to one point, topologically…) Now, if the semantic operations were connected to the syntactic ones in such a 'topological' way, they too would have to lead to the same result, *i.e.* to the same meaning.

The danger of such a(n) (mis)interpretation of the homomorphism requirement is mentioned by Moortgat, who for this reason recommends a rather proof-theoretic account of compositionality instead of an algebraic one.[40] Partee, on the other hand, concentrates on the proper interpretation of what counts for a rule. She points out that the correspondence does not reach the level of particular syntactic resp. semantic operations, but rather remains on the relatively general level of the overall scheme of the construction of the system of syntax and semantics. She noted (Partee 1997) that

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[39] See e.g. Partee (2004).

[40] Moortgat (1997, p. 121).

> The syntax is given by a recursive specification, starting with a stipulation of basic expressions of given categories and with recursive rules of the following sort:
>
> The syntax is given by a recursive specification, starting with a stipulation of basic expressions of given categories and with recursive rules of the following sort:
>
> *Syntactic Rule n:*
>
> If α is a well-formed expression of category A and β is a well-formed expression of category B, then γ is a well-formed expression of category C, where $\gamma = F_i\,(\alpha, \beta)$.
>
> In such a rule, F_i is a syntactic operation; it may be as simple as concatenation or […] arbitrarily complex and not even necessarily computable […].
>
> The semantics is given by a parallel recursive specification […]:
>
> *Semantic Rule n:*
>
> If α is interpreted as α' and β is interpreted as β', then γ is interpreted as γ', where $\gamma' = G_k\,(\alpha', \beta')$.
>
> In such a rule, G_k is a semantic operation […].
>
> As the schematic illustration of the rule-by-rule correspondence requirement above illustrates, the homomorphism requirement applies at the level of rules, or derivation trees, not at the level of the particular syntactic or semantic operations employed in the rules.

Whether the above explanation is sufficient for Montague's intentions or not, it is by no means sufficient to explain the detailed way in which syntax is connected with semantics within categorial grammar. We have no rules here, except the Functoriality Principle alone. What is done by rules or operations in other grammars (including Montague's), categorial grammar achieves by categorial assignment to lexical items (see e.g. Steedman 2000, p. 31). Thus the rule-to-rule correspondence explains nothing. Some authors recognize the fact that although syntax and semantics are very closely related in categorial grammar, the exact nature of this link remains underspecified. But instead of specifying it, they prefer to saturate their presentation with words conveying a sort of uncertainty or a mental distance:

> Categorial Grammar is a formalism accomodating both syntactic categories of expressions and *more* semantic types of objects. The former will be used in the syntactic component of a linguistic application […] while the latter will occur *rather* in its semantic component […]. Even so, the *suggestion* of the framework is that the two perspectives are systematically *related*.[41]

It is our job then to examine this relation more closely.

[41] van Benthem (1995, pp. 24–25).

In my opinion the main cause of this common reluctance to attempt to solve these problems is the notorious conceptual confusion about the levels of the FP, which was diagnosed above. The FP has *three* levels, as we have analyzed, not two. We have (FPa) – the level of syntactic positions of expressions; (FPb) – the level of semantic categories of expressions; and (FPc) – the level of ontological categories of the *designates* of expressions. The syntax-semantics dichotomy is thus conceptually insufficient to properly describe the relation in question.

An example of such insufficiency may be found in (Steedman 2000, p. 36). The author establishes the syntax-semantics interface in the guise of *The Principle of Categorial Type Transparency* and illustrates the idea with the following example: '[A] verbal function from subjects to propositions in English may be of type *S\NP* whereas a function from objects to predicates must be *S/NP*', where S/NP and S\NP are intended as the syntactic elements, whereas respective functions are intended to be the semantic ones. Now, even leaving aside the evident mistake (if the function corresponding to S\NP is 'to propositions', then the function corresponding to S/NP must be to propositions as well, not 'to predicates'), we have a serious problem there: whereas 'propositions' (not without doubts, to be sure) can be regarded as something *more semantic* (closer to the extralinguistic reality) than categories like S/NP, surely 'subjects' and 'objects' cannot. If S/NP's belong to the (FPb) level, then 'propositions' can be viewed as belonging to (FPc). But 'subject' and 'object' – as parts of sentences in the traditional sense – belong rather to (FPa). Where the functions from 'subjects' (FPa) to 'propositions' (FPc) belong – and how they are related to semantic categories of (FPb) – I dare not imagine.

A proper examination of the 'syntax-semantics interface' must involve the relations between the three levels. And as we will immediately see, there again emerges a number of serious, fundamental problems and controversies.

(FPa) → (FPb) → (FPc). This one-way relationship is easily discernible. Every operator has to be a functor, given that funtors are characterized as expressions requiring arguments and together with arguments forming compound expressions, i.e. as expressions that can serve as operators. It is moreover assumed that every functor has to denote a certain function, namely one which assigns a denotation of the compound expression formed by this functor to denotations of the functor's arguments. We dubbed functions of this kind 'Ajdukiewicz functions'.

The above relationships are *quasi*-analytical – analytical because they result from definitions of the concepts of syntactic position and semantic category; and *quasi* because, as demonstrated in the discussion of the postulated definitions of semantic category, they fail to attain the precision required of regular definitions. In truth, one can even imagine accepting the Funtoriality Principle on level (FPa) and rejecting it on levels (FPb) and (FPc) – as is the case in generative semantics (see below). Theoretically, one could even treat functors as structural expressions which denote nothing at all. This, however, would be to deny the very *idea* of functoriality, as it would effectively equate functors with diacritic marks and strip

their distinct character of any semantic value. Accordingly, we will stick to the intuitive understanding of the Functoriality Principle, whereby every functor denotes some Ajdukiewicz function. This is all the more justified since it is only this assumption that lets us grasp the seemingly mysterious 'binding together' of arguments by the operator: argument denotations are quite simply arguments of functions denoted by the operator.

The reverse relationships are less straightforward.

(FPc) → (FPb). The question is whether it is functors alone that can denote functions (Ajdukiewicz functions in particular). A strong intuition expressed by Roman Suszko (1958 and 1960) and also accepted in Montague grammar,[42] suggests that there exists a *connection of conformity* (to use Suszko's expression) between the semantic categories of expressions and the ontological categories of expressions' designates. The terminology in this wording may suggest a one-to-one correspondence between the respective categories, in which case not only every functor would denote a certain function, but also functors alone would denote functions. Put more generally, the kind of objects constituting designates of an expression would determine the semantic category of this expression. And it is this very interpretation of the *conformity requirement* that is most commonly assumed to be at work in the categorial grammar – explicitly or implicitly. Explicitly we can read this *e.g.* in (Chierchia et al. 1989, p. 2): 'Each entity […] is classified as belonging to exactly one type'.

Of course, this interpretation has many advantages, particularly a neat formalism. Besides, it establishes a very simple understanding of the syntax-semantics relation. Unfortunately, however advantageous this interpretation would be in formal, properly constrained languages, it seems hardly possible to maintain it in natural languages. And it would be against Suszko's original intentions that lie behind his 'conformity' ideas. Suszko himself has stressed (Suszko 1960, p. 72) that the hierarchy of ontological categories he defines is not a classification; in particular, it lacks mutual exclusivity. Formal details of this definition are to be found in Suszko (1960, pp. 68–69).[43] Here it will suffice to say that the hierarchy of ontological categories rests on the so-called fundamental sequence of universes: the sets of designates of expressions belonging to the basic semantic categories. Further, the hierarchy develops by induction, incorporating families of subsets of the sets belonging to it, as well as sets of functions mapping the sets belonging to it (or the Cartesian products thereof) into sets belonging to it. This hierarchy is thus relative to the assumed sequence of basic universes, with there being nothing said about the content of these universes. They need not be homogenous, for instance. It is thus possible that one of these universes, e.g. the universe of names' designates, will also contain (in addition to 'absolute', 'metaphysical' individuals) certain functions or properties or situations that simultaneously belong to some

[42] And, after Montague, often repeated elsewhere, see e.g. Carpenter (1997), Steedman (2000).

[43] An almost identically structured hierarchy of ontological categories is in Montague (1974a, pp. 192–193).

higher-level categories in the hierarchy. Accordingly, there can be no talk of one–to–one correspondence, or, in other words, of a complete conformity between ontological and semantic categories. Thus, the assumption considered here offers no possibilities of unequivocally determining, based on the ontological category of an object, the semantic category of the expression having this object as its designate. Even if the object is a function – it can be a designate of a certain functor, but equally well a designate of a name – provided that functions occur in the universe of name designates in the given language.

And this is exactly what we expect of the natural language. The assumption of 'connection of conformity' between the semantic categories of expressions and the ontological categories of expressions' designates is valid for a one-way relation only, and does not preclude that, for example, a function cannot be a designate of a name. This is why the assumption can be so intuitively and so widely accepted: it is almost obvious – at least in natural language – that any object may be given a name, and that we have to give an object a name if we want to talk about it. This is the case of any function, the Ajdukiewicz function in particular. The expression 'Ajdukiewicz function' is in fact a name, and it denotes precisely the Ajdukiewicz functions. Eventually all the higher categories are included in the universe of names; so finding out what kind of object – ontologically – we are dealing with does not determine the semantic category of the expression associated with this object.[44]

The same is true about situations – if we are about to adopt a situation semantics:

> It is important to insist on the difference between describing a situation and referring to a situation. Situations are described by indicative statements, as in (1), whereas they are referred to by nominals, as in (2) , for the purpose of describing some other situation:
>
> (1) Jackie was biting Molly.
>
> (2) Jackie's biting Molly distressed Joe.
>
> Note that if we wannt to refer to the state of affairs described in (2), we must again use some noun phrase, for example the nominal in (3):
>
> (3) Joe's being distressed by Jackie's biting Molly upset Jonny. (Barwise and Perry 1983, p. 67).

(FPb) → (FPa). In this part things are even less clear. The rough question is whether every functor has to be an operator in every compound expression in which it occurs. Some observations would help to refine this question.

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[44] That's why, probably, Geach was so 'singularly unimpressed' when told about how each object determines a set of properties, which was supposed to justify the Montagovian style of interpretation of the proper names. Lloyd Humberstone recalls such an exchange from a discussion after Geach's lecture (Humberstone 2005, p. 287, note 8). For more details of the Geach vs. Montague controversy see below.

Firstly, it is pretty obvious that not every functor in a given expression has to be the expression's *main* operator, i.e., the operator which, together with its arguments, constitutes this very expression. As it is known, in many expressions there is more than one functor, but all expressions have precisely one main operator – as in Ajdukiewicz's classical example, 'The lilac smells very strongly and the rose blooms' (Table 2.2.3.1), where all the words except 'lilac' and 'rose' are functors, but 'and' is the sole main operator (cf. Ajdukiewicz 1967, pp. 225–226):

Table 2.2.3.1 *Example 5*

The lilac	***smells***	***very***	***strongly***	***and***	***the rose***	***blooms***
|	*s* **(1,1)**		|	|*s/ss* **(1,0)**|	| *s* **(1,2)** |	
|*n* **(1,1,1)**|	| *s/n* **(1,1,0)**		|		| *n* **(1,2,1)** |	|*s/n* **(1,2,0)**|
	|*s/n* **(1,1,0,1)**|	| (*s/n*)/(*s/n*) **(1,1,0,0)**	|			
		| **A** |	| **B** |			

-

A= ((*s/n*)/(*s/n*))/((*s/n*)/(*s/n*)) (1,1,0,0,0) **B= (*s/n*)/(*s/n*) (1,1,0,0,1)**

Thus, as we can see in the analysis above, some constituents of the analyzed sentence can still be compound expressions, so we need another order of semantic-categorial analysis, where we will again have an operator and its arguments, and so on. Accordingly, a syntactically coherent expression may actually have several operators, each of a different order. Our question can now be put as whether every functor in a given compound expression has to be *an* operator of *some* order, or whether we can have functors which are not operators of any order and serve only as arguments for other functors?

Well, another observation goes from the fact that the present elaboration takes into account also compound operators, not only arguments. Such operators, quite obviously, may consist of several functors, of which one is the operator within the given compound operator, and the rest are its arguments. In the example discussed here, this is the case with the functors 'smells' and 'strongly'. These, if taken in isolation, are operanda of certain other operators, but taken together, they actually form a certain operator. We can see this in the notation of their syntactic position: although the last term in the sequence is not zero, a zero does occur in the sequence. This allows for further refinement. Now our question is what happens when it is not operators/functors but basic-category expressions (such as whole sentences) that consist entirely of functors: can there be no zeros whatsoever in the notations of the syntactic positions of such functors? Can there be sentences or names exclusively made of functors?

The answer to this question is by no means obvious. In Ajdukiewicz's sentence about the lilac and the rose every functor is an operator of some order (or a constituent thereof), but is this always the case? Ajdukiewicz himself admits that under certain conditions we can have a sentence consisting of just two functors, *s/(s/n)* and *s/n*, with the former being an operator, and the latter being the operator's argument. However, having said that, Ajdukiewicz goes on to make a curious remark: 'The principles of the word-formation of natural languages require, however, that the functor [*s/(s/n)*] functioning as the subject, i.e. as the argument in a sentence, should be a noun (i.e. a term) [name]' (Ajdukiewicz 1978, p. 280). It is thus unclear whether such an expression is still a functor or already a name of some kind.

Ajdukiewicz's uncertainty has been cleared to the bottom, apparently. In virtually all contemporary accounts of categorial grammar the analysis of a sentence into *s/(s/n)* and *s/n* is freely licensed. The most important reason for it is the problem of quantification.

Ajdukiewicz in his seminal paper (1967) devised quantifiers as a very special form of sentential operators (*s/s*), heavily restricted as to the possibility of 'multiplying out' with higher-order operators. This solution looked quite plausible at the beginning, when mere syntax (were) considered: the arguments of quantifiers devised in such a way – i.e. sentential functions – are syntactically capable of being the arguments – in the same contexts – of sentential connectives: negation, alternative, conjunction, implication or equivalence. It seems natural then to credit to them the category *s* (the name 'sentential function' strengthens this impression, as well as the fact that some of the sentential functions' combinations can be credited with a truth-value assignment, e.g. tautologies). However, the semantic counterpart of such a syntactic structure was obscure. In particular, it was not at all clear what kind of entities would correspond to and – accordingly – what kind of semantic function would correspond to the quantifiers themselves. On the other hand, Fregean semantics[45] quite straightforwardly induces the interpretation of sentential functions as the sets of objects that satisfy the given function, which suggests the identification of such functions with predicates rather than sentences (which in turn amounts to identifying quantifiers with *s/(s/n)* functors).[46]

Such an identification was proposed in the 1970's. Peter T. Geach (1970, p. 4) follows Aristotle in his analysis of the pair of Greek sentences, 'petetai Sŏcratēs' (Socrates is flying) and 'păs anthrŏpos petetai' (every man is flying). In positive

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[45] It is perhaps worth mentioning that when Ajdukiewicz was writing his paper, there was no semantics available at all. Semantic issues were broadly considered as burdened with paradoxes and impossible to treat properly and precisely. It was the time when Tarski was only introducing his definition of truth. Formal semantics was about to emerge several years later. In 1935 semantic obscurity was nothing distinctive in Ajdukiewicz's proposal (and in subsequent years he disclaimed it himself).

[46] It should be noted here that quantifiers are sometimes treated on a par with qualifiers (i.e. adjectives) and assigned the category *n/n** (usually with some additional constraints imposed on *n**) – see e.g. Buszkowski 1987, pp. 42–43. It is quite an exceptional treatment, though.

form both these sentences appear to be structurally similar (the name 'Socrates' in the former being replaced with the expression 'every man' in the latter), but their negations are different. We now have 'ou petetai Sŏcratĕs' and 'ou păs anthrŏpos petetai'. Geach, employing medieval grammatical intuitions, claims that the main operator (or *formale*, an element whose negation is equivalent to the negation of the whole sentence) in the latter sentence is 'păs anthrŏpos' (every man) and that it must be assigned the category *s/(s/n)*, forming a sentence with the word 'petetai', or 'flies' (*s/n*). In this approach, the phrase '(not) every man' – a so-called *quantified phrase* – (a) is syntactically coherent and (b) is a constituent part of the sentence '(not) every man is flying', which is analyzed into functors alone.

Similar propositions were put forward *inter alia* in Lewis (1970, p. 40) and Cresswell (1973, p. 131). The problem with such an account is that quantified phrases combine easily with proper names in conjunctions, like 'Socrates and every man' or 'John and most of his colleagues'. Some of these conjunctions cannot be analyzed as elliptical forms of sentential conjunctions ('John and many girls were looking at some person' means something different than 'John was looking at some person and many girls were looking at some person': in the former sentence it is decided that John and the girls look at the same person, whereas in the latter it is not). Thus they must be treated as they are: the conjunction (called a 'generalized conjunction') conjoins not only sentences, but expressions of any category, provided it is the same category for both constituents. *Und hier ist der hund begraben*. According to Geach's proposal 'John' (a proper name) has a different category (*n*) than the quantified phrase 'many girls' (*s/(s/n)*), which – as it stands – cannot license the generalized conjunction.

One solution, a bold and impressive one, but eventually implausible, was proposed by Montague (1974a). He stipulated that all nominal phrases (NP's), including proper names, belong to the *s/(s/n)* category.

That this is not a good solution was pointed out by Barbara H. Partee and Mats Rooth (1983).[47] They noticed that although 'there seemed to be no harm and considerable gain in uniformity in […] treating [all nominal phrases] always as <<e,t>,t>' (p. 360) when the interpretation of a single sentence was concerned, things got more complicated when attention was turned to discourse analysis, especially discourse anaphora.[48] The point is that some NP's license such anaphora; some do not:

John/the man/a man *walked in. He looked tired.*
Every man/no man/more than one man *walked in. *He looked tired*

[47] *Nota bene* for Geach this solution was implausible from the very beginning. '[W]e have two different syntactic categories' – he wrote. – 'This is a profound insight, ignored by those who lump together proper names and phrases like *every man* as Noun Phrases'(Geach 1970, p. 4).

[48] The Montagovian semantic type <<e,t>,t> corresponds roughly to the category *s/(s/n)*.

The generalization seems to be – say Partee and Rooth – that only e-type (that is referentially used and belonging to category *n*) NP's can license a singular discourse pronoun. Quantificational ones (*s/(s/n)*'s) cannot.

Having thus recognized the need for an *s/(s/n)*-interpretation of nominal phrases (in a generalized conjunction) and simultaneously an N-interpretation (in discourse anaphora), the authors recommend introducing a type-shifting principle in order to switch easily between *n*'s and *s/(s/n)*'s when necessary.[49] This solution - reinforced by formal development and generalization in the type theory[50] – eventually became standard in many later publications (cf. e.g. Casadio 1988, van Benthem 1995, Moortgat 1997, Carpenter 1997, Steedman 2000) – under many, slightly different names: 'category/type-shifting/lifting/raising' (the terminology is so unstable that different names for the same procedure are used by the same author in the same paper on the same page – cf. e.g. Bach 1988, p. 26).[51]

The idea behind *category-shifting* (let us stick to this term) seems very simple and convincing. Both names (*n*) and alleged quantified phrases (*s/(s/n)*) combine with a predicate (*s/n*) to yield a sentence (*s*):

$s/n\ n \rightarrow s$
$s/(s/n)\ s/n \rightarrow s$,

which, by interchangeability, seems to license an identification – in a sense - of these categories. Or any categories *x* and *y/(y/x)*, for that matter.

Now, this state of affairs is nearly universally warmly welcome. Grammars allowing for category-shifting (usually accompanied by some other procedures, such as functional composition, for instance) are given honorary names, like Combinatory Categorial Grammar or Flexible Categorial Grammar, and it is stressed how good they are in capturing some syntactic properties of natural languages. There is no harm in it – as Partee and Rooth would say.[52]

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[49] In fact, they recognize the need for switching among three distinct categories – the third is the predicate category *s/n*. However, such a switch is not as easily licensed by the type theory as $n \rightarrow s/(s/n)$. Furthermore it confuses the '*referential* vs *quantificational*' distinction among NP's with the '*attributive* vs *predicative*' distinction among adjectives. We will discuss the latter in Chapter 4 separately. Anyway, in subsequent literature only the $n \rightarrow s/(s/n)$ switch found its place.

[50] Type-shifting rules were already developed in the Joachim Lambek categorial calculus in the 1950's.

[51] The *category – type* distinction is justified on some special occasions; we will discuss it later.

[52] A notable exception to this general applause is van Benthem (1989). The author raises the need of systematical reflection upon the semantic motivation of the type theory and about the limitations of category-shifting procedures embedded in modern versions of categorial grammar. He concludes with the prediction that semantic constraints on type changes are to be imposed so that the class of admissible ones would be restricted. Also Kai von Fintel expresses some skepticism about explaining discourse anaphora in terms of category-shifting procedures: 'Anaphora resolution is a complex business […] whose description and analysis does not need to be, and hence shouldn't be, replicated in the principles of grammar'(von Fintel 1997, p. 16).

This overwhelming acceptance for category-shifting is what I am going to challenge. Let us put aside, for a moment, the matters that are allegedly solved by adopting this procedure: generalized conjunction and quantification. We will attempt to treat them properly in Chapter 4. Here I will limit myself to expressing just a little doubt whether category-shifting really works as well as it is declared. Afterwards I will attempt to show that – regardless of whether its victories are true or fake – it is not harmless at all. So even if it is successful and we want to have it, we must pay for it – and quite a lot, I daresay.

The doubt follows from the observation that both kinds of phenomena: those which require shifting names into *s/(s/n)* and those which require leaving them at base type *n* can occur simultaneously in the same case. Consider:

'John and some girls walked in. The girls were playful but *he* looked tired.'

It is a perfectly natural construction. I have heard something like this many times. And in case some native speakers should declare authoritatively that I must have heard some bad English, because in the vernacular this is an incorrect construction, I will point out that at least its Polish version is perfectly natural *and correct*. Now, if we admit such constructions, we have quite a serious problem with what type to assign to 'John'. It is conjoined with a quantified phrase, so perhaps *s/(s/n)*. But at the same time it licenses a discourse pronoun in the next sentence. So rather *n*. Or something is wrong with type-shifting itself.[53]

As to the other harms, let us begin with the fact, although perhaps not the most important, that type-shifting rules concern *quantified phrases* as wholes, leaving obscure the question of *quantifiers* as such. Many authors feel free to treat the phrases 'quantified phrase', 'quantifier phrase', and 'quantifier' as synonyms. This is misleading. 'Quantifier phrase', for instance – the term employed by Lloyd Humberstone (2005) in his commentary on Geach – can be, and should be understood as 'a phrase in which the quantifier is connected with what is quantified' – this is the intended meaning – or perhaps 'a phrase that simply is a quantifier'. It seems that in (2005, p. 292) Humberstone makes such a mistake himself: he describes Geach's quantified phrase 'John or James' as simply a 'quantifier', which is syntactically incorrect. In order to show it, let us resort for a moment to predicate calculus and a typical formula Qx[x is P]. 'Q' or at most 'Qx' can count as a quantifier here, whereas a quantified phrase, as understood in Geach (1970, p. 6), is the unsaturated string 'Qx[x…]'.

This problem is not merely terminological, though. It is a serious material problem of what to consider a quantifier and what category to assign to it. Roughly speaking, the difficulty lies in the quantifier-prefix distinction. Which is the operator? Sole 'Q' would not explain itself as binding x-shaped variables rather than

[53] Anyway, it is hardly questionable that shifting is used very carelessly by many authors. Mineur and Buitelaar, for instance, feel free to assign different types to 'an example' and 'a speaker' without a word of justification (1996, p. 128). Such an approach is very common in contemporary technical works in CCG – you need a category, you have it.

y-shaped ones. However, 'Qx' would hardly manage, either, because 'x' in 'Qx' and 'x' in 'x is P' are essentially different expression-types. The latter is a separate expression belonging to a definite semantic category; the former is not. We cannot analyze 'Qx' into 'Q' being an operator and 'x' being its argument (preserving simultaneously the same interpretation for x in 'Qx' and in 'x is P'). The problem was dealt with formally by Adam Nowaczyk, initially in English (1978), later, in greater detail, in Polish (1999).[54]

Another difficulty one can discover concerns the FP(a) level of the syntax-semantics hierarchy (and as this level is a very popular subject of negligence, the harm is often neglected, too). Namely, it is true that both names (*n*) and expressions of the category *s/(s/n)* combine with a predicate (*s/n*) to yield a sentence (*s*). But the structure of the resulting sentence *s/n n* is completely different than the structure of the sentence *s/(s/n) s/n*. Both categorizations are syntactically coherent, but they are different kinds of sentences with different patterns of syntactic roles. The point is that in the former categorization the predicate is the operator and the nominal phrase is its argument. In the latter the order of functional application is reversed: it is the predicate that is the argument, and the nominal phrase is the operator. To put it more illustratively, let us assume that *n* is a set of headphones with a 'little jack' plug, *s/(s/n)* is a CD-player with a 'big jack' slot for headphones and *s/n* is a converter taking small jacks to yield big ones. Now, both combinations: the little jack with the converter and the converter (alone) with the CD-player make functional wholes. However it makes little sense to 'shift' little jacks to CD-players, doesn't it?

However, the most important – in the perspective of this book – harm that is done to syntactic theory by category-shifting is the very fact already mentioned at the beginning of this section, namely that it blurs the distinction between basic and derived categories and allows for sentences being analyzed into mere functors. The distinction has been argued for above. The analysis of the sentence (which belongs to a basic category) into mere functors (derived categories) amounts to parting with the most fundamental insight of categorial grammar that underlay the construction of language by Frege: the idea that any composition that is supposed to yield a new (saturated) entity from some parts must consist of combining something 'saturated' and something 'unsaturated', an object and a concept (or function). In particular, any compound expression must be composed with an 'unsaturated' functor and a 'saturated' argument. A sentence built up from mere unsaturated functors is something unthinkable in the Fregean framework. Allowing for such sentences, together with the difficulties mentioned earlier, I consider this a very high price to be paid for the not-at-all certain gains coming from category-shifting.

Of course, it is not the case that the same objections concern all formal modifications of Ajdukiewicz's original calculus. There are some technical devices which substantially facilitate analyses without violating (at least so radically)

[54] Some difficulties of this sort are also mentioned by Peter Simons (2006, p. 246).

fundamental intuitions. For instance, the so-called functional composition, originally proposed in (Geach 1970, p. 5), can be fruitfully accommodated.[55] It is not a type-change procedure but an additional 'multiplying-out' procedure.[56] If a classical Ajdukiewiczian procedure as described above can be summarized as:

(A) $$\alpha / \beta \quad \beta \Rightarrow \alpha \qquad (2.2.3.1)$$

then we may formulate Geach's additional proposition as:

(G) $$\frac{\alpha\beta \Rightarrow \gamma}{\alpha\beta / \delta \Rightarrow \gamma / \delta} \qquad (2.2.3.2)$$

which nowadays is most commonly presented in a slightly weaker form as:

(Composition): $$\alpha / \beta \quad \Rightarrow \alpha / \gamma \qquad (2.2.3.3)$$ [57]

Functional composition helps describe some forms of negation or adverbial modification particularly well, allowing for substantially greater flexibility. We will return to this topic in Chapter 4.

2.2.4 Atomicity Principle, Categories and Types

One of the major principles of categorial grammar, associated with the FP, is the so-called *Atomicity Principle* (AP):

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[55] The so-called 'crossed substitution', formulated by Steedman after Anna Szabolcsi's original proposal (Steedman 2000, p. 50), can also be included here.

[56] The expression 'multiply out' is often written in quotes (by Geach and by other writers, *e.g.* by Humberstone (2005)); it is absent from dictionaries too. This suggests – as a non-native English speaker I cannot be quite sure – that this phrase is a neologism. If so, it may be worth saying that this is a literal translation of a common Polish word 'wymnożyć' which is used by school pupils (and sometimes teachers, too) to convey the meaning 'to multiply in order to get rid of too many figures in the formula' (which is especially useful in formulas with fractions). In a sense 'multiplying out' is then quite the opposite of (mere) 'multiplication': it does not multiply, but reduces the number of objects being 'multiplied out' (*scil.* the figures in the formula). In our particular case 'to multiply out' means roughly the same as 'to reduce a fraction'. Ajdukiewicz tried to avoid terminology that would be associated with operations on mathematical fractions (because his rule of reducing syntactic 'fractions' differs substantially from the mathematical one); but many of his Polish commentators plunged into it freely (most probably including Ajdukiewicz himself when talking, not writing). It may not be completely impossible then that Geach, who has a very good command of Polish (close to native) and visited Poland many times, adopted this phrase from this common jargon.

[57] Geach has provided also separate formulas for many-place functors. I will skip here this technical complication.

(AP) *If we have the categories of the atomic constituents of a compound expression, we can obtain the category of the compound.*

This is uncontroversial, so far, and quite luckily so, because it is precisely the AP that is responsible for the productivity of language, i.e. the possibility to formulate or recognize as well-formed an unlimited number of compound expressions never heard of before. But in the vast majority of work on the topic more than that is assumed , namely that we *do have* the categories of the atomic constituents when we start analyzing the syntax of the language. And this is very much controversial in natural language. It is a vital question: where do the categories come from? On what grounds can we put a word into a semantic category?

The importance of this question is not widely recognized, though. It is overshadowed by the use of the theory of types for representing categorial structures and virtually identifying categories with types.[58] The theory of types is a very elegant and powerful mathematical tool, no doubt. It can clarify many issues and suggest interesting solutions to certain problems. It is quite natural then that many authors are apt to shift the subject of syntactical reflection from categorial grammar to a sort of 'type-logical grammar'.[59]

Nevertheless, some important points are lost in such a translation (or rather illegitimately gained, to be precise). Mathematical representations and notational systems are powerful enough to enable solutions otherwise impossible to obtain (the decimal representation of numbers versus the Roman notation is a very good example), but sometimes they can just bypass some problems without really solving them. This is the case with type-logic as a mathematical representation of semantic categories. Categories are certain *sets* of expressions. Types, on the contrary, are just *symbols* corresponding to these sets. To a certain degree, obviously, we can consider categories and types parallel: an expression belonging to a functor category designates the function that assigns the designate of the whole compound expression to the designates of the functor's arguments, and accordingly the type of the functor determines the function that assigns the type of the compound expression to the types of the functor's arguments. But in two aspects, at least, the parallelism between categories and types has its limits.

Firstly, some formal operations available in type-theory cannot automatically be applied to categories (or they would yield some unwelcome or uninterpretable outcomes). Examples can be borrowed from the previous section. The so-called functional composition, a procedure drawn from the type-theory to reduce two

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[58]One can find a typical (*nomen omen*) – and influential, due to the encyclopedic character of the publication – example in (Moortgat 1997, pp. 96, 98), where the use of the phrases '*categories (or types)*' and '*categories/types*' amounts to suggesting that there is no significant difference between the two notions.

[59] Cf. e.g. Carpenter (1997), Buszkowski (2003). The latter gives an explicit statement on the issue: 'Grammars based on logics of types are traditionally called *categorial grammars* […]. From the modern perspective, the term *type grammars* seems to be more adequate…' (p. 322).

functor types into one, can be easily interpreted in the categorial system as the composition of the Ajdukiewicz's functions. Type-shifting – as it was argued above – being an equally legitimate type-theoretical procedure, is not equally legitimate within the categorial system (if the argument is correct, it is quite illegitimate, I would say). In this case a property of a mathematical representation distorts the picture of what was intended to be represented.

Secondly, the very definition of categories and, respectively, types reveals a characteristic asymmetry. The recursive definition of types can be as simple as this:

(i) *n*, *s* are types;

(ii) if *a* and *b* are types, then *a/b* is a type.

That's it.

It is not, however, the definition of respective categories.[60] Such a definition would require an initial enumeration of the expressions belonging to the categories typed *n* and *s*, and introducing a procedure for qualifying expressions into the categories typed with compound types.

Thus, the question of assigning particular words to certain categories – and a proper justification of it – being an immaterial or even nonexistent problem in the type-theory, simultaneously is one of the most urgent problems of the theory of categories. It concerns the material foundation of the formal principle of atomicity, or speaking more generally, the starting point of the analysis of syntax.

The very problem how to determine the categories of words was noticed already by Ajdukiewicz, who decided to bypass it without really solving it. He merely stated that 'we assume that the semantic category of a single word is defined by its meaning' (1967, p. 120). It seems, however, that this is a counterfactual assumption, when natural language is concerned.

Why don't we have initial categories when we start analysing the syntax of natural language? For one thing, we need to account for language acquisition, and it is quite obvious that at the very beginning of language acquisition we have no semantically interpreted lexicon – to say nothing of the augmentation of this lexicon with categorial markers.[61] We have just some innate cognitive schemes and external data, which are utterances and (mainly) physical, concrete objects in the scope of our perception.[62] As Eli Dresner points out, it is precisely the problem of initial assignments (categorial as well as semantic) – that makes 'the model theoretic framework[63] […] not adequate for the purpose of modelling first language

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[60] For an example of not respecting this distinction see (Zeevat 1988, p. 203).

[61] Cf. Lewis 1970 (meaning = intension [a function from indices to denotations] + categorial marker).

[62] At some point some mental states of the learner can be taken into consideration; but it is not necessary to account for it now.

[63] Embedded in standard accounts of categorial grammar (MT).

learning […]. In this framework the assignment of denotations and extensions to linguistic expressions is primitive; it is the starting point. Therefore in this framework we do not have the means through which to describe a gradual process in which expressions come to have properties of names and predicates, a process that seems to be central to first language learning' (Dresner 2002, p. 427).

For another thing, at later stages, an excessive categorial ambiguity lessens the plausibility of any kind of initial categorial assignment. The fact that different tokens of the same expression-type (hence these are not cases of homonymy) can be placed into different semantic categories[64] is very often ignored. Sometimes such an omission leads to unnecessary theoretical proposals. For instance, Humberstone (2005, p. 287) rightly points out that many problems that troubled Geach in his (1970) and motivated some particular solutions proposed there, would have disappeared if the fact had been acknowledged.

When recognized – as in e.g. Casadio (1988) – the fact is very often underestimated. Normally it would be mentioned as just a case of formal complication (initial type-assignment associates a set of types, not just one type, with an atomic expression). The picture of categorial analysis in these cases is more or less such that we pick up from these sets the types that suit us. Alas, such an analysis is perhaps doable for two- or three-word compounds, but certainly not for longer strings. There we have the so-called combinatorial explosion. A ten-word compound in which every word can belong to just two categories (a very modest initial assignment – most words have a much richer repertoire) has $2^{10} = 1024$ possible readings. Processing it by the elimination of implausible concatenations is completely absurd as a model of the real behavior of the language user. Besides, we still don't have the answer for the question of where the initial assignments come from – whether ambiguous or unambiguous. How it is that a word's meaning would 'define' its category (or categories).

Some authors do acknowledge the importance of the fact and seek to adjust the syntactic theory accordingly. For instance, we read in (van Benthem 1989, p. 232) about 'the undeniable fact that types in natural language are indeed flexible and polymorphic'. However, van Benthem considers this fact 'the most fundamental motivation […] for studying type-shifting', which is a very implausible direction on our grounds. Besides, van Benthem does not show how exactly type-shifting alone could possibly account for type ambiguity[65], and again, what is the source of these types (regardless of whether they are subject to subsequent change or not).

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[64] Negation, for instance, would be sometimes *s/s*, and other times [*s/(s/n)]/[s/(s/n)]*. Adjectives can be normally *n/n*-s – in the so-called attributive readings – or just *n*-s, in the predicative readings (predicative readings can also be interpreted so that adjectives are non-detachable parts of predicates (*s/n*), accompanied by the copula). Nouns in the genitive can be *n*-s (in objective position) or *n/n*-s (as parts of subjects). Words like 'very' can be *n/n*-s (in 'very beginning'), (*n/n*)/(*n/n*)-s (in 'very beautiful'), [(*s/n)/(s/n*)]/[(*s/n)/(s/n*)]-s (in 'very well'). And so on, and so on…

[65] I am not aware of any type-shifting/lowering principles that would license all the changes mentioned in the previous footnote.

In order to resolve this issue, let us see how we really do the analysis – for instance in lecturer's practice, when teaching students categorial grammar.

As We Do It in Practice

Well, we write 'The lilac smells very strongly and the rose blooms' on the blackboard, and say:

'As you see, this is a compound sentence (*s*) consisting of two sentences (*s*) connected with the connective 'and'. Since this connective makes an *s* of two *s*'s, it belongs here to the category *s/ss*. So we can analyze the whole sentence as shown in the first line of the Table 2.2.3.1.

Further you can see that both these sentences are simple; one says something of a lilac, the other – of a rose. Thus in the second order of analysis the word *lilac* is an argument in the first sentence and the word *rose* – in the second. These are atomic expressions, referring to some objects, so we can say that they belong to the category of names *n*. The functor *blooms* ascribes the whole sentence *rose blooms* (*s*) to the word *rose* (*s*). Therefore it must have (in this particular context) the category *s/n*. We can say the same – in the case of the lilac – of the expression *smells very strongly*. It also must be *s/n*. So we have the second order of analysis completed (Table 2.2.3.1, second line):

But, *smells very strongly* (*s/n*), as opposed to *blooms*, is still a compound expression, so we have to analyze it further. Let us come back to the rose, for a moment. What does it do? It blooms. Just blooms. The lilac could also just smell, couldn't it? So the functor *smells very strongly* can be divided into just *smells* – which is interchangeable with the whole and therefore can be assigned the category *s/n* – and the rest *very strongly*, which plays the role of operator, making *s/n* out of *s/n* and thus belonging to the category (*s/n)/(s/n*). *Very strongly* in turn is interchangeable with mere *strongly*, which means that *strongly* belongs to the category *(s/n)/(s/n)* and *very* must be a functor belonging to *[(s/n)/(s/n)]/[(s/n)/(s/n)*]. This allows us to complete our analysis in the way shown in Table 2.2.3.1, total.

This is what we actually say and do. According to the common picture of analysis (initial assignment + multiplying out rules = category of the compound) it is plain *petitio principii*. Of the expression whose category we are supposed to calculate we say at the very beginning, initially, that it is a sentence (*s*). On the other hand, instead of initially assigning categories to functors like 'and' or 'blooms', we calculate these categories. Moreover, we obtain the category of compound functors like 'smells very strongly' *before* we can say anything about the categories of its constituents!

To account for this actual procedure would require some rethinking of the issue of initial categorial assignment.

We can distinguish three major features of the procedure. (1) The distinction of basic and non-basic categories is heavily exploited: only expressions belonging to basic categories can really refer to something real, extralinguistic, so only basic categories can be recognized initially on the basis of meaning. On the other hand it is possible to initially assign a basic category to a compound expression without realizing its structure, provided its meaning is given (e.g. ostensively). (2) We begin with discriminating as big constituents as possible, leaving atoms (words) for the last stage. (3) We make use of the *Reverse Atomicity Principle*:

(RAP) *If we have the category of the compound expression and the categories of the arguments of the main functor in this expression, we can obtain the category of this functor.*

In a sense, the RAP is the same equality as the AP, but what is given and what is sought is different.

Now, all these features have been noted in the literature, although separately and usually in rather peripheral comments. As to feature (1): we have remarked that already the problem of initial assignment taken generally is not very commonly discussed; the observation that there is a substantial difference between basic and non-basic categories is still less popular. The remark of Bach (1988, p. 24), who somewhat sarcastically points out that 'among the possible categories available to languages, and hence the little language-learner, are ones like these: t/((e\e)/e) t/(t/(t/(t/e)))'[66] can be counted as a rare exception. Feature (2) is not very popular, either. I have found a relatively clear statement of this feature only in Bartsch (1998, p. 133), where it is acknowledged that parsing a sentence or a phrase consists of seeking constituents as big as possible in the already parsed strings.[67] At the same time it seems very important. If we had begun the analysis of Ajdukiewicz's sentence about the lilac and the rose with assigning basic categories to atoms, we would have had to content ourselves with 'lilac' and 'rose' as *n*-s and the string 'smells very strongly and … blooms' as *s/nn*. In the very next stage we would have had to declare complete failure, because there is no sensible analysis of this string.

Only feature (3) has received relatively significant attention in the literature. Something resembling the Reverse Atomicity Principle is mentioned by Moortgat (1997, pp. 97–98), who adds, however, that the initial categorial assignment can be made in the way of hypothetical tentative assumptions to be verified in the course of analysis. The details of such a procedure remain obscure, especially the guidelines along which we are to make categorial assumptions. And without some we certainly would not make it. We do not make assumptions on random basis – that would yield a combinatorial explosion, mentioned above. More than that: we

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[66] These Montagovian types would correspond roughly to ours *s/((n/n)/n)* and *s/(s/(s/(s/n)))*.

[67] Perhaps such a recommendation is more popular in technical literature concerning details of actual parsing algorithms – no wonder why. What I am complaining about is the relative absence of discussion of this feature in theoretical works about syntax.

evidently must make such assumptions in a very highly principled way, because the cases of the rejection of a once assumed category are very rare. In case of failure of analysis we are much more apt to supplement the analyzed expression with some additional, 'elliptical' parts – or entirely rephrase it - than to revise the categorial assignments.

We can find still more attention paid to the RAP in the works of Wojciech Buszkowski. He introduced the so called *reverse stratification rules* (Buszkowski 1987)[68], which would allow calculating the categories of the constituents provided we have the category of the compound *and its structure*: the complete description of the syntactic positions (FPa level) of all the constituents. In other words, according to Buszkowski, categorial analysis is possible even if we do not know the categories of atomic expressions. We must know, however, which ones are operators, and which – arguments. I would consider this a serious drawback. It is not at all clear how we could obtain this syntactic structure of the (FPa) level, and – additionally – how we could learn about the category of the compound whole. This licenses, in my opinion, the statement that the above-mentioned attempts have not succeeded in explaining in a realistic way the process of categorial analysis.

Here I will sum up my proposal, taking hints from the previous discussion and leaving the details to Chapter 4.

The initial data for analyses are expressions of basic categories, both atomic and compound. We can know a category of a compound expression prior to analysis, provided it is a basic category. We cannot know the structure of such a compound (still prior to analysis), but we can know those of its constituents that belong to basic categories. These constituents are arguments of the compound's main functor, the category of which can be subsequently calculated according to the (RAP).

Of course, we do not need to know the category of all basic expressions, especially compound ones. (We cannot know that, frankly speaking – there is infinitely many of them.) It is enough if we can know the category of some of them (including some compound ones). It is enough to have initially a *base* of a category – its finite and relatively small subset. Then, in the course of analysis we can, firstly, enlarge the base according to the interchangeability principle (by adding new expressions interchangeable with those already classified into the category), secondly, calculate the categories of the functors according to the reverse atomic principle, thirdly at last, when we already have some functors, we can straightforwardly employ the atomic principle – and traditionally calculate the categories of the new compounds. Switching from one of these three possible strategies to another can eventually lead us to generate all the syntactic structures of the language. Let us notice that from a certain point we can employ interchangeability also to introduce new functors (esp. compound ones). Generally, all the procedures are the

[68] This theme returns in Buszkowski (2003) in a substantially richer formal instrumentation, without substantial changes in the heart of the matter, though.

easier to perform, the longer are performed (the amount of data needed for the calculations rapidly grows).

Thus, we are going to modify Ajdukiewicz's assumption so that not all the lexical atoms are classified into categories by virtue of their meaning, but only some names and sentences (both atomic and compound), belonging to the bases of respective categories are.

The idea of bases of categories was proposed by Montague (PTQ in 1974a, p. 250), but my account would differ quite substantially from it. Montague, namely, introduced bases for all the categories *except* basic ones and simply declared (in a more or less arbitrary way) which words would belong to these bases. The whole procedure had a purely technical (sense) of grounding the recursive syntactic rules. According to my proposal, as contrasted with Montague's, we need the bases for basic categories, and by no means are they arbitrary.

Indeed, what are they? What is the source of the expressions that populate the bases of basic categories? Well, this is the source of language in general: ostensive procedure. We learn the meaning of some expressions by ostension and at the same time we learn that they are names or sentences. We will discuss how it works in details in the third chapter. Before we proceed to that, let us stop for a while to comment on some minor issues concerning the Functoriality Principle. The Reader not interested in these details can skip the remaining sections of this chapter.

2.3 Some Consequences of the Functoriality Principle

2.3.1 Functoriality and Compositionality

The Functoriality Principle, which says – roughly – that in every compound expression we can distinguish a part denoting a function that maps the denotation of the whole compound expression to the denotations of the arguments of this part, can be easily mistaken for the so-called *Compositionality Principle*. The latter says that 'the meaning of a compound expression is a function of the meanings of its parts' (Janssen 1997, p. 419).

Since such a wording is a very general one, some authors remark that as such this principle is rather a truism: because we have only a finite and pretty restricted lexicon at our disposal and we can interpret a theoretically unlimited number of compound expressions, it is obvious that we can read their meanings from the meanings of their parts and the way they are connected together (cf. e.g. Sainsbury 2002). It is obvious that compositionality holds for a great many cases of actual interpretation. The question is whether a theory can explain compositionally all

such cases or rather leaves some of them to be accounted for contextually (which amounts to saying that sometimes the meanings of some words are to be established only by the context in which they are uttered). So compositionality becomes rather a methodological requirement than a factual statement: theories are judged according to whether they admit non-compositional explanations or rather manage to explain all the postulated constructions compositionally (cf. Janssen 1997).

The Functoriality Principle is connected with the Compositionality via Atomicity Principle, discussed above. As we have argued, the Atomicity Principle should be generalized so that it could encompass the reversibility of Ajdukiewicz's Functions denoted by functors. The AP can therefore hold straightforwardly, which accounts for the Compositionality of some constructions, and reversely (RAP), which can be seen as a tribute to Fregean Contextuality. Thus the Functoriality Principle is pretty neutral in the controversy about compositionality. From the formal point of view, when the relevant functions are reversible, one can hardly tell the difference between Compositionality and Contextuality at all. Categorial grammars, conforming to the FP, can be purely compositional, but can be somewhat contextual as well. It depends on how much of the RAP is admitted to be in use. As I have argued, we need some RAP-analyses, especially at the beginning of the reconstruction of a given language, for practical reasons.

And that's the point. The real difference between Compositionality and Contextuality lies not in the formal issues, but in the practice of analysis. In logical or methodological accounts the relations among the parts of an expression are synchronic (not to say: extratemporal altogether). The whole can be the function of the parts and the parts can be functions of the whole (and other parts) all at the same 'time'. The practice, on the other hand, is diachronic: something must come first: the whole, or the parts.[69]

So, the real issue is whether this or that particular sentence uttered in these or those particular circumstances is rather compositional or contextual And it is pretty obvious that it can be both ways, depending on the occasion. A natural but technical language: of handbooks, manuals, scientific publications and official announcements is usually compositional – the words have commonly known meanings, standardized and precise (often accompanied by regulatory definitions to avoid misunderstandings), indexicality and all kinds of pragmatical relativisations are kept down as much as possible. The sentences themselves can therefore be extraordinarily compound and complicated; not exceptionally we have to deal with the first ever occurrences of such sentences in the history of human speech. There is no other way of their interpretation than to compose them according to the rules of syntax.

Things are quite different in common, every day language (especially when we're only learning this language). One of the important sources (in the case of

[69] That is perhaps why many researchers connected with the logical or mathematical tradition insist on the compositionality of the theories of syntax, whereas the contextualists recruit themselves rather from the psycholinguistic, empirical tradition.

first language acquisition – the only source) of meanings is the ostensive procedure, and therefore the situational context. Such a context often allows us to grasp the meaning of the whole compound expression (e.g. as denoting a salient situation in our environment) without realizing the meanings of its parts or even its actual syntactic structure. We can only compute the latter later, in due analysis. Such an analysis would be highly contextual.

2.3.2 Intralinguistic Definition of Syntactic Operations

Many authors believe the 'fact that [categorial grammars] are built on the notion of function in the strict mathematical sense' (Bach 1988, p. 22) – which is sometimes referred to as the Functionality Principle – to be the most important characteristic distinguishing them from other syntax calculi, and from generative grammar in particular (cf. also Casadio 1988). I have acknowledged this myself in the preliminary paragraphs of the current Part of the book. Nevertheless I find it important to point out another fact, of no lesser significance, and yet often overlooked or underestimated.

The Functoriality Principle provides namely that syntactic operators – functors – are *parts* of compound expressions. This means that admissible syntactic operations may be determined intralinguistically, they are somehow indicated[70] by actual parts of compound expressions. I will make this rather vague statement more precise by considering what is usually termed the 'lexicalism' or 'lexicality' of categorial grammar. By this term (let's stick to 'lexicality') the authors mean that 'properties of the macro-grammatical organization are fully projected from lexical type declarations' (Moortgat 1997, p. 171), 'the lexical entries for words do most of the grammatical work of mapping the strings of the language to their interpretations' (Steedman 2000, p. 32) or 'all particular linguistic information is put in the initial assignment of types to lexical atoms' (Buszkowski 2003, p. 328). Now, I would be quite happy with these definitions if they were lacking one point which from our point of view seems far too strong. I am fine with 'all particular linguistic information is put in the initial assignment of types'; I object to 'lexical atoms'. In the light of the previous section of the book, lexical atoms – words – are of no use to us. We shall take the information from the initial category assignment understood as above, which is rather a distribution of basic types among some simple and compound expressions, not a declaration of atoms or lexical entries.

[70] The syntactic operation connected with the functor performing the role of the operator assigns to the functor's *expression*-arguments a compound *expression* and must be distinguished from the Ajdukiewicz function *denoted* by the functor, which is the function mapping the *denotations* of arguments to the *denotation* of a compound expression. Hence the term 'indicate' for this particular connection as distinguished from 'denote'. The difference between the two is a reflection of the difference between levels (FPa) and (FPc) of the syntactic description.

Thus I would object also to the very term ‘lexicality’ and prefer the rather longer but more adequate phrase ‘intralinguistic definition of syntactic operations’. The point is, namely, that indeed we need to have the linguistic information in the expressions alone, which is contrasted with the idea of linguistic information encoded in some external production rules.[71] Not lexicality but intraliguisticality is the heart of the matter here.

One way of further specification of what it is all about is saying that every legitimate syntactic operation consists in adding a functor-expression to the set of its arguments. For example, in the sentence ‘Mary has a cat’ the operator ‘has’ indicates the operation *has* (or – say – O_{124}) defined as follows: *has* (‘Mary’, ‘a cat’) = ‘Mary has a cat’ or ‘Mary has a cat’ = O_{124} (‘Mary’, ‘cat’).

That every syntactic operation in categorial grammar consists in adding a new expression to the set of its arguments can be overlooked due to two easily misinterpreted facts.

Firstly, every grammar assuming the FP can be formulated in such a way that syntactic operations are left apparently ‘outside’ expressions. This is possible thanks to the measure of flexibility in the division of expressions into the descriptive (denoting) and the structural. For example, we may say that the sentence ‘Mary has a cat’ consists of three parts, the middle one being the operator denoting the function assigning the denotation of the sentence ‘Mary has a cat’ to Mary and some cat. Alternatively, if we so prefer, we can just as well claim that this sentence consists of two descriptive parts for which there is defined a certain external syntactic operation, namely O_{124} (or *has*). In other words, we have no problem with external operations consisting in adding a certain part, in which case this

[71] The latter idea is perhaps best instantiated in simple phrase structure grammar. Phrasal rules apply to specific strings of symbols, namely to the expressions themselves and to the symbols of semantic categories accepted in a given grammar. These rules work by rewriting single symbols (always being symbols of a semantic category) as a non-empty strings of other symbols (including symbols of categories or expressions themselves. The initial element is always the symbol of the ‘*s*’ (sentence) category, which roughly corresponds to the category of sentences, while the terminal elements are simple expressions or dummy symbols. An appropriate set of rules makes it possible to derive a deep structure of any sentence from the *s* symbol (to generate this sentence - hence the name ‘generative grammar‘). A very characteristic feature of generative grammar is that the domains of phrasal rules consist of symbols of semantic categories whereas the counterdomains are of hybrid nature, comprising both ordinary expressions and category symbols. For this reason the rules cannot formally be termed syntactic operations, and they are instead dubbed ‘*rewriting rules*’. De facto, however, these rules do indeed perform the role of syntactic operations.

These are operations that are characterized only externally. No concrete expression in the larger whole is given a special status with regard to any such operation. In order to derive a sentence, we have to have the full set of operations before we can proceed to the level of atomic expressions at all. As we know, when generating sentences, we start off with the symbol ‘*s*’ (or ‘sentence’) and then for a while — a long while in complicated cases — we keep replacing a succession of category symbols with strings of category symbols. The atomic expressions of the sentence being reconstructed emerge at the end of the process.

part is to be interpreted as an operator whose arguments are the operation's arguments.

The reverse, however, is not true. Not every externally defined operation may be 'incorporated' in an expression without altering the given language structure. Let us say, for example, that 'Socrates' father' = O_{28} ('father', 'Socrates'). In this case, operation No. 28 on two names yields a compound name, but we cannot interpret this operation as a correlate of an ordinary name-forming functor operating on two name arguments, and this because there is no such functor in the name 'Socrates' father'. In fact, the functor here is the word 'Socrates'', and it is a *single-argument* functor.

Secondly, some views on concatenation may obscure the picture here. Many works emphasize that concatenation is the only syntactic operation in categorial grammar (cf. e.g. Oehrle et al. 1988). In a sense, this is of course true – for all grammars. But this sense is rather banal and misses the point.

Concatenation, or the consecutive arrangement of an expression's parts, one after another, is the most elementary and best 'visible' operation lending expressions a linear order. In spoken language this operation is inevitable: the time in which an expression is uttered is one-dimensional and the expression's elements simply have to be uttered one after another. Even if there were languages in which the order of expressions is completely irrelevant, they would still have to display an order of some kind, if only one created at random, because it is simply not possible to utter all words simultaneously, in one instant. Not so essential is concatenation in written language. Ajdukiewicz[72] describes a hypothetical language in which the order of compound expression parts is not significant, which means that these parts (in written form) may be randomly distributed over a surface or, indeed, in a three-dimensional space. This is what we call a purely inflectional language. In practice, however, when dealing with natural language – also in written form – it is hard to imagine giving up the linear order, and hence concatenation. Written language to a certain extent reflects spoken language, if only in the fact that words are put on paper in the same order as a speaker would utter them. Besides, the linear ordering of expressions – whatever its origin in spoken language – is an excellent vehicle for all manner of information needed to interpret utterances. To do away with this ordering, although theoretically possible, would be to do away with the economy of communication. We can thus say, without much risk of error, that concatenation is a universal in the theory of natural language, or, in other words, that there are no purely inflectional natural languages – an opinion, incidentally, shared also by Ajdukiewicz [73]. This is probably the reason why it is commonly accepted that relations between the parts of a compound expression in language are based on the single relation of linear ordering, e.g. on the 'succession-in-time' relation in speech or the 'immediately-to-the-right-of' relation in European systems of written language. This view is in no way controversial (being downright banal,

[72] For more details, see Ajdukiewicz (1978 and 1979).

[73] Cf. Ajdukiewicz (1979, p. 89).

as we already suggested) if we interpret it as follows: The linear order of the compound expression's parts, introduced by concatenation – being a necessary consequence of the very nature of speech as a process spread out in time (with the order of words being imposed by the order of moments of time) – is what may be called a 'natural environment' for other syntactic operations, in the proper sense of the term, which may exploit this ordering (e.g. to effectively indicate functors and their successive arguments), and in this sense are 'resting' upon this ordering. So far, this is harmless.

There is a stricter interpretation of this view, however, namely that concatenation, rather than providing material for syntactic operations proper, is itself the most important – or, in radical treatments, the sole – syntactic operation of the given language. The question now to answer is: Do categorial grammars indeed rest on this more radical interpretation?

The answer to this question depends on how we define syntactic operations, the operation of concatenation in particular. If we give a purely formal definition of these operations, namely as ordered *n*-tuples of expressions, and if we additionally assume some rules of correctness of the concatenated strings,[74] and, further, if we recognize these rules as being external with regard to the definition of syntactic operation, then we can answer the aforementioned question in the affirmative: on the grounds of categorial grammar we can indeed formulate a definition of language lacking any explicit reference to syntactic operations other than concatenation. The problem is, however, that in a grammar of this kind, we also indicate distinguished positions and define special relations between the various positions. Because of this, syntactic operations other than concatenation by no means disappear from language. Instead, they are merely characterized *implicitly*, for instance when semantic categories are being defined or when we resort to language correctness rules. The characteristic we are talking about here consists in specifying which categories of expressions can occupy special positions, or which category combinations can be placed next to each other in concatenated sequences (and with what result). One example here can be the following wording in a definition of the *s/n* category:

If expression α belongs to (s/n)/(s/n) *and expression* β *belongs to* s/n*, then expression* αβ *belongs* to s/n.[75]

A definition thus constructed, although formally a definition of a semantic category, is in fact also a definition of a syntactic operation, which says that the compound expression αβ is well formed if expressions α and β satisfy specific conditions, namely that α is an operator and β is this operator's argument (with this being determined by their respective semantic categories). One cannot therefore

[74] We have to assume such rules to prevent just any sequence of words from being recognized as a correct expression of a given language.

[75] This is one of the induction steps in the recursive definition of the single-argument predicate category.

say that the syntax of any compound expression is in this grammar reduced *exclusively* to the way this expression's parts are combined. On the contrary, in cases such as this we also say that, for example, the part on the extreme left is the operator of the expression as a whole (in Łukasiewicz's notation) and that, accordingly, it has to be of a certain category, *etc*. The arrangement of parts (the order in which they occur in a compound expression) is here nothing more than a 'technical device' indicating which of the parts is the functor, and which parts are its successive arguments. As we know, this can be indicated in other ways as well, e.g. with inflectional suffixes or parentheses. Here, the syntactic operation proper – the one allowing us to identify the appropriate semantic operation and to assign an interpretation to the compound expression – is defined by the functor's category.

Summing up: we have a plenitude of syntactic operations in categorial grammar and they are encoded in expressions, not given separately. As can easily be seen, grammars in which we have syntactic operations that can only be characterized 'externally', independently of the expressions themselves, fail to formally satisfy FP, the reason being that according to them a compound expression would have no *part* that would play the role of the operator. However, as in the case of purely positional languages, formally based on the concatenation operation alone, the FP can be satisfied *de facto*, namely when, in addition to formal operations, we also define a set of additional rules governing the *correctness* of operations in such a way that we distinguish in the expression a part whose denotation is a function assigning the denotation of the compound expression to denotations of the remaining parts of this expression. This is the case in the Montague grammar.

Montague (1974b) starts building his model of grammar by introducing bases of eight semantic categories, namely two basic categories of proper names and sentences, and six functor categories corresponding to functors typical for everyday English language.[76] The bases contain examples of paradigmatic expressions belonging to each category and comprise the first stage in the recursive definition of category *tout court*. The second stage of this definition consists of 17 inductive conditions, the first of these being a formal condition guaranteeing the inclusion of the bases in the appropriate categories, and the remaining 16 corresponding to the principal syntactic types of the English language. The said conditions provide that in such and such a combination of parts, of which all but one are already included in an appropriate category, the remaining part belongs to such and such a category.

By way of example, let us consider the simplest of all the conditions, S2. This says that if expression δ belongs to category C_2, expression α belongs to C_0, and concatenation $<\delta, \alpha, \varphi>$ belongs to relation R_2 which is characterized by the fact that any concatenation $<\delta, \alpha, \varphi>$ belongs to it always and only if φ = 'αδ', then expression φ belongs to category C_1. In Montague, category C_0 corresponds to the

[76] In his general treatment Ajdukiewicz places virtually no restrictions on the size of the group of functor categories, with the mechanisms he envisages allowing us to add new categories as the need arises. Six categories practically suffice to reconstruct the syntax of everyday language.

category of (proper) names, C_1 to the category of sentences, and C_2 to the (functor) category of single-argument predicates. An important element of this recursive condition (and all the others save for the first one) – and one that is instantly intriguing – is the relation R_2 (resp. $R_3 – R_{17}$), being a formal representation of a specific *syntactic operation*. Montague (1974c, p. 224) gives a generalized definition of an *n*-argument operation as an (*n* + 1)-argument relation in which the first *n* arguments are operanda and the last one is the result of the operation. The statement that a concatenation $<\delta, \alpha, \varphi>$ belongs to the relation R_2 may thus be rephrased as $O_2(\delta, \alpha) = \varphi$. Thus, in this particular case, the relation R_2 represents an operation forming a sentence out of a single-argument predicate and a single name.

It is easy to see that what we have here is an operation that is external with respect to the expression. This is so because the predicate is not an operator but one of the operanda, theoretically on a par with the other one (a name in this case). The question now is whether in Montague grammar there is some way of actually realizing the Functoriality Principle, that is to say of assigning a special role to functors within a compound expression. The fact that definitions of semantic categories are based on syntactic operations suggests that the answer probably is yes, that functor categories will be in a way adapted to the operations that are to be performed on these functors. This supposition is confirmed in the semantic part of Montague's theory.

In this part of his theory Montague characterizes 16 semantic operations relating to the 16 conditions of the recursive definitions of categories; the only formal condition lacking an equivalent here is S1, which says, *pro forma*, that categories include their bases. Semantic operations assign the denotation (denotation function) of the result of a given syntactic operation to the denotations – or, more precisely, to denotation functions[77] – of the syntactic operanda. Semantic operations are defined in such a way that the denotation of the main functor of a given compound expression is given a special distinction.

Let us consider the example of the semantic operation F_2 correlated with the syntactic operation O_2 (i.e., with relationship R_2 occurring in the induction condition S2 discussed above). The definition of this operation is as follows:

$$F_2(d, a) = \textit{object } p \textit{ such that } p = d(a).^{78}$$

This definition allows us to distinguish the functor δ in a compound expression, based on the fact that its denotation *d* is a function mapping object *p*, i.e., the denotation of sentence φ, to object *a*, i.e., the denotation of name α. The respective

[77] A denotation function maps strings of objects into expression denotations featuring variables in place of which these objects may be substituted (Montague 1974b, pp. 193–194). One needs to (make this complication) to be able to properly represent denotations of formulas with variables – in the Montagovian framework. However, this is completely irrelevant to our considerations here.

[78] Cf. Montague (1974b, p. 202). This is a simplified version of the definition, featuring only denotations and not denotation functions; cf. the previous footnote.

denotations of the functor and the name are thus by no means on a par with each other. We thus have here the fundamental task of the Functoriality Principle performed on levels (FPb) and (FPc): we can distinguish a part in a compound expression whose denotation is an Ajdukiewicz function.

It may be that the 'external nature' of syntactic operations on level (FPa) and the simultaneous satisfaction of FP on levels (FPb) and (FPc) is the reason for the measure of uncertainty as to whether Montague grammar may be considered a categorial grammar. Although in oral discussions scholars readily acknowledge that it does belong here, a certain terminological opposition seems to persist nevertheless: Montague grammar is classified as one of the research paradigms *apart from* categorial grammars rather than *within* those grammars (cf. e.g. Oehrle et al. 1988; van Benthem and ter Meulen 1997).[79]

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[79] Normally we (are dealing) with grammars which satisfy or do not satisfy the FP altogether, at all levels (categorial grammar and simple phrase structure grammar being paradigmatic examples of the former and the latter respectively). However, since we are presently considering some mixed cases, it may be interesting to remark that whereas Montague grammar satisfies (FPb) and (FPc) but not (FPa), there is also a grammar that satisfies (FPa) but not (FPb) and (FPc) – being 'dual' in this sense to Montague. This is the so-called 'generative semantics' (cf. e.g. Lakoff 1970). This semantics does without phrasal rules, instead proposing general rules of correctness of a node in the derivation tree. Its semantic interpretations are integrated with syntax determinations: the rules governing the syntactic correctness of an expression also make it possible to extract this expression's meaning. The fundamental rule of node correctness (putting aside the issue of quantifier contexts) says that an S-type node has to dominate over exactly one node of PRED (predicate) type and over one or several nodes of ARG (argument) type. We at once see a clear resemblance to categorial grammar here. However, this superficial similarity masks profound differences. To begin with, a more in-depth look at rules of node correctness reveals that they fail to conform to the Functoriality Principle. It turns out that a PRED node may dominate not only over predicates (which would be in line with the FP), but also over adverbs (predicate-forming functors operating on predicate arguments or sentential connectives (sentence-forming functors operating on sentential arguments) as well as over diverse other expression categories – with no conformity of arguments whatsoever. Secondly, arguments (ARG nodes) may dominate the S node, something that would be acceptable in categorial grammar only on the condition that the ARG in question is the argument of the functor serving as a sentential connective. However, in generative semantics, ARG dominates over S *in nearly every case*, regardless of the kind of PRED an argument of which this ARG is. What this means is that the distinction between PRED and ARG does nothing to mutually adapt semantic categories of appropriate expressions to one another. Also, this distinction does not carry through to the object level: it is out of the question for a PRED-category expression to be designating something (an Ajdukiewicz function in particular). The semantic component in generative semantics differs from its counterpart in standard generative theory in many respects, although in one respect it is perfectly in harmony with it: it continues to be what Lewis (1970) called a non-referential semantics of the 'Semantic Markerese' type.

We may thus say that generative semantics satisfies the Functoriality Principle only on the level of syntactic positions (FPa). Indeed, in every correct compound expression (in particular, in every sentence) we can distinguish precisely one part which may be assigned to the PRED category; we can then repeat this procedure if any of the parts distinguished in the expression is itself a compound expression. However, we are unable to precisely determine the respective syntactic roles performed by this element and its 'arguments', i.e., we cannot determine its/their semantic

Now, why is this intralinguistic determination of syntactic operations so important? When learning our first language, we never learn syntactic operations explicitly – the only thing we learn are expressions, at least in the first stages of the learning process. As Quine (1970, p. 101) put it, 'neither the transformation rules nor the formation rules are explicit in the minds of those who learn a language as native speaker'. It is only advanced users who may perfect their command of the language by getting to know additional, external rules formulated in the language that they are already familiar with. Therefore, if we are to know syntactic operations other than concatenation, these operations have to be either innate, or encoded in concrete expressions. As is known, the generativism that does not respect the FP is a fairly radical nativism: generative models of language acquisition assume a large body of innate information. Categorial grammars offer the hope that we will be able to describe the mechanism of language acquisition without having to make such far-reaching assumptions.

Indeed, the close connection between 'lexicality' – as they call it – and learnability is stressed very strongly by the aforementioned authors who discuss this issue, although – says Moortgat (1997, p. 171) – the initial assumptions of actual learning theories are quite unrealistic so far. I am entertaining a hope that this work will bring them a bit closer to reality. So let us proceed to Chapter 3: (a realistic, ostensive) Semantics.

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categories. Accordingly, the Functoriality Principle is not satisfied on level (FPb). Needless to say, the non-referential character of generative semantics means that FP is not satisfied on level (FPc) either.

3 SEMANTICS

Non ergo grammaticus sed philosophus,
proprias naturas rerum diligenter considerans...
grammaticam invenit.[1]

Abstract

In this chapter we are seeking to outline a semantics that would match the syntactic requirements, introduced in Chapter 2. It is argued that we shall concentrate on ostensive procedure of language acquisition with much more attention than it is usually done. Ostensive meanings are indispensable for the semantics of not only a few simple primitive names, but of many compound names and sentences as well. Thus, a short survey into a prototype/stereotype theory of the meaning of names is made, and a longer excursion to the foundations of situation semantics, in the style of Barwise and Perry's. The problems of ostensive meanings of sentences, semantic entailment and ambiguity of nominalization are discussed.

Keywords Ostension, Meaning, References, Names, Sentences, Situation Semantics, Events, Nominalization

3.1 Some Technical and Logical Problems with Ostension

Chapter 2 ended with a statement that we need to recognize some names and sentences as such without any kind of analysis – purely on ostensive grounds. Let us now examine in detail how this works.

The essence of the ostensive procedure is that the speaker utters an expression in the presence of some object and the hearer has (1) to attach the expression to the actual designate (the object present) and – sometimes much later – (2) to generalize the meaning of the expression to cover its whole denotation.

There are many particular problems to solve in the pursuit of this aim. Let us mention just a few of them, the ones that are perhaps the most salient for the philosopher of language. Firstly, the hearer has to distinguish the very expression that is to be defined ostensively – from the continuum of sounds that surround him. Secondly, he has to distinguish the object to be designated – from the continuum of the reality he lives in. Thirdly, he has to find the aspect in which different objects are similar (or indiscernible) when they are designates of the given expression and – if it is similarity that counts – he must realize the degree of similarity

[1] A motto from thirteenth and fourteenth century treatises on grammar.

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which is sufficient to establish the proper relation. These problems are not amenable to easy solutions and I am not aware of any successful attempt to get rid of them altogether. But there are of course quite effective ways of dealing with them separately in each case.

A very good analysis is given in *First Language Acquisition* by Eve V. Clark (2003). To explain generalizations, for instance, Clark discusses many 'assumptions' about how the learning process goes on.[2] Let us mention those which are most interesting from a philosophical point of view:

Firstly, there is an *automatic concentration on some key features of objects: shape, size, dimensionality, relative amount, time, cause and kinship* (pp. 140–141). These features can serve as default aspects for the similarity/indiscernibility relation.

Secondly, the so called *taxonomic assumption* is postulated whereby 'children appear to assume that a term like *squirrel* picks out just squirrels and not complexes of squirrels-on-branches or squirrels-eating-nuts, just as a term like *swing* picks out just swing, and not swings-with-children-on-them or swings-and-trees' (p. 134).

It would be interesting perhaps to compare this empirical constraint with some philosophical concerns postulated by Jerry Fodor in (1998). He remarks that when learning English as the first language 'the child is […] provided with a good sample of stereotypic English sentences, from which, however, he extracts not […] the concept STEREOTYPIC ENGLISH SENTENCE but the concept ENGLISH SENTENCE *TOUT COURT*. But why on Earth does he do that? […] [T]he answer *must* be that it's *a law about our kinds of minds* that they are set up to make inductions from samples consisting largely of stereotypic English sentences to the concept ENGLISH SENTENCE […] and not from samples consisting largely of stereotypic English sentences to the concept STEREOTYPIC ENGLISH SENTENCE' (p. 139). I would risk a hypothesis that Clark's *taxonomic assumption* can be – in a rough approximation at least – identified with Fodor's *law about our kinds of minds*. It does precisely this work: sets up a range for generalizations in the ostensive procedure. I will not pursue more fine-grained approximations, though.

Thirdly, Clark recalls the *basic-level assumption*. It says that not all of the hierarchical taxa are equally cognitively accessible; on the contrary, there is some level most readily generalized to. It is 'dog' rather than 'poodle' or 'animal'. Thus, in the absence of suggestions to do otherwise, children automatically generalize to this particular level, usually (but not exclusively) a biological species.[3]

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[2] By 'assumptions' Clark means automatic learning mechanisms working as if the child made an assumption consciously. Alternatively, they can be regarded as a sort of meta-assumptions in the theory, postulating the existence of certain mechanisms to explain the learning of facts.

[3] It seems that different people (esp. children and adults) may have a different notion of what is a basic level taxon for them. It would explain an intriguing phenomenon: that children will negotiate the meanings of words. They act as if they knew the meaning better than their mothers and they appear to win the negotiations for a while. In the case reported by Clark (p. 36; without ex-

The above mentioned abilities are useful in dealing with the second problem: generalizations.[4] There are some different abilities, helping in identification of words and objects.

Clark argues, for instance, that as speakers we use a special form of *child-directed speech*, different in pitch and intonation, which helps the child-hearer to set off the speech directed to him from other conversation and background knowledge (Clark 2003, pp. 38–39). Children, for their part, show an early (probably innate) *ability to categorize the sounds* that surround them: they impose discrete categories on the acoustic continuum.[5] They can also automatically and subconsciously '*segment out chunks or* words *just on the basis of statistical relations among the sounds involved*' (p. 62). Another ability that is relevant for elucidating the issue is, according to Clark, the so called locus of attention which can be jointly adopted by the speaker and the hearer. Clark names several markers of such a *locus of joint attention*: direction of gaze, pointing gestures, physical stance and orientation of the speaker and so on (pp. 138–139).

There is an interesting omission here, though. All these markers are insufficient to explain why the kid is likely to concentrate on the object pointed at rather than on the act of pointing (or pointing device) – very distinctive itself. Why the kid follows our gaze instead of examining carefully our wide-open eyes? Why he turns towards the squirrel we have just pointed at instead of looking at the unusually stretched out finger?

It seems that we cannot do without assuming some Husserlian intentionality anyway. Some acts – such as pointing somewhere – are automatically interpreted as intentional. This need is strengthened by the problem of identification of the kind of object we look at. It is an old Quinean problem of indeterminacy: is *gavagai* a rabbit, or an essential part of a rabbit, or a property of being a rabbit, or a situation that there is a rabbit (Quine 1960)? Clark rightly points out that Gestalt psychology would exclude some of the possibilities; the 'assumptions' considered in the literature, some of which are mentioned above, and pragmatic hints exploited

planation) the kid, after naming correctly a mouse in the picture, points at another picture, showing squirrels, and says: 'mouse'. Mother corrects him, saying: 'they are squirrels', but he insists: 'mouse, mouse, mouse'. The mother gives up: 'All right, they are mice'. Why such insistence? Why the kid doesn't accept the correction? My tentative answer would be that he has a larger basic level taxon. Not any particular species, but rodents in general. And he has already learnt that the word for this taxon is 'mouse'. He just refuses to recognize as relevant for taxonomic purposes the difference between mice and squirrels. Just as he would do when presented with some pictures of a dog and a poodle.

[4] Clark argues also that constraints such as these, postulated in the literature, are not quite satisfactory – we need to appeal additionally to some pragmatic features of the learning process (2003, p. 138).

[5] It is worth noting that this mechanism is not restricted to acoustic continua and is not only a human ability. It is perhaps a very general cognitive ability: our perceptual apparatus, presented with some (pseudo)continuum of data, imposes automatically (and perhaps somewhat arbitrarily) some categories on it. It is probably this very mechanism that produces the vagueness paradoxes, so troublesome from the logical point of view, so harmless in practice.

in her own approach, no doubt reduce the range of possible misunderstandings. But, it is not enough. It may suffice to distinguish an object against a part of an object or a group of objects; it may rule out properties (as abstract entities that cannot be directly perceived) – but it is not enough to separate objects and situations that here-and-here there is an object. There is no way to tell whether *gavagai* is a rabbit or rather a situation in which there is (moves) a rabbit. And here we have Husserlian analysis again. We can categorize reality into objects and situations and perceive both. It is our intentional attitude towards stating rather than mere referring that makes us use sentences instead of names – or more to the point: that turns our utterances into sentences, not just names. In real life, there is nothing in objects to make the distinction. It is entirely up to us. It is us, speakers, who decide whether we speak about a rabbit or a situation in which there is a rabbit.

Now, the problem that a child faces is not to tell objects from situations (both can be named) but rather to guess the speakers' intentions in the particular case. This problem is quite complicated, as it requires a rather clear recognition of the two possible intentions by the child in itself. No wonder the emergence of syntax is quite a late phenomenon in first language acquisition.

As Clark points out, up to the age of 2, although children already use nearly a hundred words belonging to different parts of speech (nouns, verbs, adjectives), it is impossible to ascribe to these words any syntactic category (Clark 2003, p. 83). It may well happen that children use the word 'door' to get something opened, and 'open' to refer to doors (p. 87). Also first word combinations, although they are already functional wholes, would not reveal any syntactic structures: flexion is absent and word order is conditioned solely pragmatically (pp. 167–177). The first syntactic constructions begin to appear as late as at the age of 2.5 in the form of the so called verb-islands: 'each verb first appears in only one or a very small number of constructions. […] Children's early verb uses may to be limited to one particular noun. […] Such verb-island uses may then be elaborated in two ways: first, children may go on to combine the same verb with different nouns […]; and second they may start adding to the arguments they produce with each verb' (pp. 180–181).

Well, doesn't it remind us of the model of practical syntactic analysis, discussed in Section 2.2.4 under the heading 'As we do it in practice'? First, we qualify verbs as functors lacking autonomous meaning. We use them once we have realized that they can produce a certain sentence from certain names (contextually). Only after firmly grasping its semantic category can we try changing words in the argument positions to produce new sentences (compositionally). Finally, we can try modifying the functor itself. What further strengthens this impression is the observation that among the first verbs acquired (and used in verb-islands) are the general-purpose verbs such as 'go', 'do', 'give' and 'put' (Clark 2003, p. 181). The main function of a verb is just to introduce some word as a logical name: make a sentence out of some names. At this point the child develops the ability to differentiate nominal and propositional intention. The actual 'meaning' of the predicate is

not so important. Most often the situation to be stated in a sentence is already in the locus of attention and can be picked as a default referent of any chunk of words uttered.[6] The child's purpose is to note that this particular chunk is already a sentence, not a name. That it states something.

Summing up, we can roughly say that this short excursion into the field of empirical linguistics reassures us in embracing the ostensive procedure as the source of meanings of many words and chunks of words (as linguists have developed a huge arsenal of tools that make ostension a doable and credible procedure) and confirms our doubts about distinguishing names and sentences on some external, referential grounds (thereby supporting the Husserlian hypothesis of the subject-dependent source of this distinction). We know the semantic category of an expression – provided it is a basic one – *with* its meaning, but not *by* its meaning. It is additional information, 'transcendental' in a sense: we ourselves shape the meanings to make them the meanings of sentences or names.[7]

Anyway, we must be able to recognize the meaning of basic expressions on the grounds of the information about them gathered in an ostensive procedure. It is obvious for names; not so obvious for sentences. Let us now examine the semantics of both basic categories.

3.2 Names

As a name I would consider any expression that designates any object, no matter what object and what license for designation.[8] Thus I would lump together proper names, demonstratives and general names – descriptions, both definite and indefinite. I must leave the proper justification of such a move for another occasion, as it would have me debating with half of the philosophy of language of the twentieth century. Let me just mention that although this is by no means a self-evident move, it is not a weird novelty either. There are recurring papers which advocate blurring the borderline between definite and indefinite descriptions or descriptions and proper names (for recent accounts see e.g. Barker 2004 and Justice 2007).

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[6] In fact, adult speech can exploit this mechanism too for introducing neologisms or invented words. See e.g. Johnson: 'Mary skinkked the dishes onto the table' (2004, p. 87).

[7] Some sort of this intuition has been acknowledged by David Lewis. In (1970) he proposed that denotations (extensions) of expressions are to be determined by the intensions as opposed to meanings. Full-fledged meanings are pairs of intensions and *semantic category indices*. These indices are thus among the initial information needed to start analyzing expressions, not to be derived from anything else (especially not from intension).

[8] Some ideas included in this chapter were originally published in my earlier paper (Tałasiewicz 2005).

When we think about ostension, proper names and singular terms used referentially do not in general cause any serious trouble. The 'original baptism' does the work well enough. There is no generalization needed: we have word and object, and that is enough. Things are getting complicated with general names (indefinite descriptions). It is especially here that we will examine carefully how we get their meaning from examples of usage.[9] Let us concentrate here on this task, leaving further comments on names in general for Chapter 4.

3.2.1 The Definition of Ostensive Meaning

Traditionally, general names designate some objects. The class of designates of a certain name is its denotation. Two names are materially equivalent if and only if when they have the same denotation. The material equivalence of names needs to be distinguished from their synonymy. While it is true that synonymous names are always materially equivalent, two materially equivalent names may not be synonymous, e.g.: 'the highest mountain in the world' and 'the highest mountain in Nepal'. We define synonymy as logical or analytical equivalence: two names are synonymous when their equivalence is not accidentally empirically true, but it is an inevitable result of so-called meaning postulates of the language. Such equivalence, *eo ipso* synonymy, is a strictly linguistic fact; checking synonymy does not require appealing to experience; only the knowledge of the language rules is needed. The meaning of a name is usually identified with its connotation, that is as a certain property (or a set of properties) of the designates, expressed by that name. The connection between meaning and denotation is clearly visible here: all and only the objects that have the property (being the meaning of the name) belong to the denotation of the name.

This approach is criticized or even questioned by many authors (e.g. Quine and Putnam) because of various doubts of a general nature (Quine's nominalism and radical empiricism,[10] Putnam's belief in social division of language work[11]). These authors object to the very idea of meaning that is 'suspended in the world of abstracts', no matter what exactly this meaning is, and postulate connecting the term 'meaning' with the human process of cognition. They believe that the traditional approach, even if it was internally consistent and seemingly intuitive, is in fact

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[9] We must remember that in our syntax-oriented context we cannot allow ourselves to call them 'predicates'. *A* 'cat' is not a predicate. It is a name. Consider: 'I saw a cat. It was very cute'. 'A cat' and 'it' are co-referential here. 'Nana is a cat' is nothing of a counterexample. We can analyse it as 'Nana' (*n*), 'is' (*s/nn*), and 'a cat' (*n*), where 'a cat' is just a name, or alternatively as 'Nana' (*n*) and 'is a cat' (*s/n*), where 'a cat' is *a part of* a predicate (but not a predicate itself). This predicate is to be analyzed further into 'is' ((*s/n*)/*n*) and 'a cat' (*n*, again). The variancy of two-place predicates: *s/nn* vs. (*s/n*)/*n* is a systematic phenomenon, to be discussed in Chapter 4.

[10] Cf. e.g. Quine (1996).

[11] Cf. e.g. Putnam (1973 and 1975).

incomprehensible, for it cannot explain (while being consistent with empirical methodology) how people can understand the meanings of words and how they use them.

However, as it turns out, this traditional approach is not even internally consistent and intuitive. Namely, some names are not synonymous – they are not analytically equivalent – and yet they express a property that is intuitively the same. For instance, the names 'the colour of a lemon' and 'the colour of a grapefruit' (assuming we mean ripe fruit of a certain kind, etc.) obviously mean something else – we need empirical knowledge to decide about their co-extensiveness – but they still seem to express one property of being yellow. Therefore, the meaning of a name cannot be identified with the property it expresses.[12]

Let us assume[13] that if two names are synonymous, they express the same property, but not necessarily the other way round; if two names express the same property, they are equivalent, but not necessarily the other way round (e.g. if by chance all the balls are yellow, the names 'yellow' and 'round' are equivalent, but they express different properties). Now, if names Φ_1 and Φ_2 are materially equivalent and the meaning of each one of them includes '*being something with respect to W'*, then Φ_1 and Φ_2 express the same property. The meaning of the name 'yellow' includes '*being something with respect to colour'* and the meaning of the name 'round' – '*being something with respect to shape'*. They are not the same respects, which is why those names do not express the same property even if they designate the same objects.

This definition can be made more precise (we still follow Barbara Stanosz here):

> If the names Φ_1 and Φ_2 are materially equivalent and their meaning is connected with the same equivalence relation defined in the universal set, then Φ_1 and Φ_2 express the same property [For simple names this implication holds in both directions. Compound names, however, may be connected with a non-equivalence relation determined by the combination of equivalence relations (the sum and complement of equivalence relations do not have to be equivalences)].

Such formulation is possible due to a very useful explanation of an unclear *respect* as a division of the universe that is connected with an appropriate equivalence relation; and of *being something* with a given respect as belonging to an appropriate member of this division (an appropriate class of abstraction of a given equivalence relation). Because two different divisions may have common members, such a structure is very useful as an elegant approach to different but coextensive properties. The meaning of the name 'yellow' is connected with the relation of having the same colour, and the meaning of the name 'round' – with the relation of the same shape. Even if all and only the balls were yellow, the

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[12] This fact was brought up by Barbara Stanosz (1970).

[13] Cf. op.cit.

corresponding properties would be different – provided that colour does not always go together with shape.

Single properties, expressed by names, can be represented here as pairs: <D(Φ), R(Φ)>, where D(Φ) – the denotation of the name Φ, R(Φ) – the relation, with which the meaning of the name Φ is connected.

The question of meaning is still unanswered, though. How should the meaning of a name be represented? To answer this question we would have to go beyond the issues dealt with by Stanosz (1970). The solution – in the light of the definition of a property that we have accepted above – has to recognize the fact that the relation *R*(Φ) is supposed to be connected with the meaning of the name.

Let us now focus only on simple, 'elementary (primitive) names like *sour*, *hard*, *red*'.[14] The meaning of these names is connected with a single equivalence relation.

To remind ourselves how the system works: a property expressed by such a name is a pair <*D*(Φ), *R*(Φ)>. The meaning should be connected with an equivalence relation *R*, which determines a certain division of the universe. The denotation *D* is simply one of the members of this division – in other words, it is a class of abstraction of the relation *R*.

Example: the name is 'the colour of a lemon'. The colour of a lemon – yellow – is represented as a pair consisting of the relation of having the same colour (let us call it 'R') and the class of abstraction that includes lemons. Let us assume that 'a' designates a particular instance of a lemon;[15] we have then: <$[a]_R$, R>. Now we will look at a name expressing the same property but having a different meaning, e.g. 'the colour of a grapefruit'. Because grapefruits (let 'b' be a particular instance of a grapefruit) belong to the same class of abstraction of the relation of having the same colour as lemons (we are considering the same property); the name 'the colour of a grapefruit' also expresses the property <$[a]_R$, R>.

But why is it 'a' - an exemplary lemon here? It should be <$[b]_R$, R>, shouldn't it? But is it an important difference given that $[a]_R = [b]_R$?

As far as the property is concerned, there is no difference whatsoever. However, intuition protests against the denotation of the name 'the colour of a grapefruit' being defined as a class of abstraction built on the basis of a lemon; and that can show us the way to the solution of the meaning problem. As far as meaning is concerned, there is a difference between the analyzed names.

Let us see where this takes us then:

The meaning of the name 'the colour of a lemon' is a pair <a, R>; the meaning of the name 'the colour of a grapefruit' – <b, R>.

Such a solution, or rather a sketch of a solution, looks suspicious at first glance. Can we agree that the meaning of a name is co-created by one of its designates? Why this one, not some other one? And if so, how is it possible for a language

[14] Remember that adjectives in the so called predicative uses are syntactically general names.

[15] Thus 'a' is constant – an individual name of a specific object.

which is not completely private to exist? What will happen when the exemplary lemon rots?

On the other hand, this solution has some very desirable aspects. It says that synonymous names express the same property, of course. But the same property can also be expressed by names which are not synonymous. It is enough if the instances are different and the appropriate classes of abstraction – the same. The meanings of names ‘the colour of a lemon’ and ‘the colour of a grapefruit’ are determined through the relation of having the same colour and through certain instances, respectively a (particular) lemon and a (particular) grapefruit. The meanings differ, because a lemon differs from a grapefruit (in fact *the* lemon and *the* grapefruit; the ones chosen for the instances); but the property is the same, because both the lemon and the grapefruit are of the same colour, so they belong to the same class of abstraction of the relation of having the same colour. Thus the basic condition postulated for the concept of meaning is fulfilled.

The following conditions are also fulfilled. Meaning is connected with the relation *R*, which is used to construct the representation of property afterwards. Meaning theoretically determines the denotation (because the equivalence relation and the instance pick out the proper member of a division). Meaning preserves – and *explicite* exposes – its semantic character.

The advantages I have listed encourage us to consider an attempt at improving this solution, so that the above-mentioned *prima facie* inappropriate description of the meaning of a name by using some of the name’s designates would not be a difficulty we could not overcome. Resorting to the ostensive procedure holds out a hope that our attempt might succeed. Such a procedure indeed consists in pointing at expressions’ exemplary designates and suggesting the respects (relations) in which other objects and those instances ought to be compared. However, whereas in a typical traditional application an ostensive definition is used to determine the *extension* of the defined term, we suggest using it as a *tout court* definition – determining the *meaning*.[16]

The first question that arises on our way to developing a meaning definition is: To what extent do we want relation R to be an equivalence? When we introduce a name ostensively, we point at certain objects chosen not as *those* objects that are included in the name’s extension but as objects *like* the ones that this extension includes. What counts here is similarity *in some respect, specified and limited*. This respect is in fact the relation *R*.

The next problem concerns acceptable limits of this similarity. There are two possible ways of describing the matter in relation to the results achieved. Firstly, we can assume that even primitive names are not connected with equivalence relations but with similarities. The meanings of such names would therefore be a system consisting of such non-equivalence relations and a set of instances. A property

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[16] Thus, our approach belongs to the family of theories gathered under the heading ‘prototypical theory of meaning‘ – a family counting among its ancestors Quine, Putnam and, of course, Kripke.

expressed by a name would be a pair of a non-equivalence relation and the denotation, i.e. the set of all the objects involved in the given relation with the instances (at least one of them).

The second possibility is accepting that the relation is fully an equivalence relation. Different, non-equivalent – according to this relation – instances pick out different classes of abstraction here. The denotation is the sum of appropriate classes.

But which classes are appropriate? Are they only the ones picked out by the instances? Not quite so, at least in most cases – no. The ostensive definition fails to indicate sufficient number of instances to pick out all classes that the denotation consists of. It indicates some typical and extreme instances – the definition is interpreted based on the assumption that the objects that are more similar to the typical ones than the extreme ones also belong to the denotation of the defined name. This general assumption can be made more precise in different ways – every one of them describes the process of creating meaning slightly differently. Let us stick to the following way: [17]

The meaning of a general name Φ is a pair $<A(\Phi), \boldsymbol{R}(\Phi)>$ where A is a set of objects pointed out in the ostensive procedure (exemplary instances) and $\boldsymbol{R}$ is a set of *implicitly* pointed out relations. $\boldsymbol{R}$ contains an equivalence relation R_r representing the respect in which the designates are supposed to be equal among themselves, and R_i – respective indiscernibleness relation. Now, all objects connected with given instances by a 'chain' of indiscernibleness in a given respect belong to the denotation: $x \in \boldsymbol{D} \equiv \exists v_1,...v_n \exists a\ [R_i(v_1, a) \wedge R_i(v_2, v_1) \wedge ... \wedge R_i(v_n, v_{n-1}) \wedge R_i(\boldsymbol{x}, v_n)]$, where a is any instance pointed out in the definition of the name.

Such an approach raises several problems and controversies. We will discuss them in the following subsections.

3.2.2 The Problem of Vagueness

If we realize that similarity (and thus indiscernibleness) can be graduated in a (quasi)continuous fashion, we will understand that the ostensive method cannot be used to draw sharp borders. And so the vagueness of a term introduced only through an ostensive definition is inevitable. How is it possible then to distinguish denotations of different names connected with the same relation (e.g. 'green' and 'yellow')? If we do not draw sharp borders, is the relation of indiscernibleness not going to lead us through the whole spectrum? The answer is: in most cases it is not, if we assume that the role of medium instances (their set is represented by the variable v in the formula above) may be played only by the objects actually observed in a real environment (or recalled as memories). It turns out that the world is constructed in such a way that even though there are no sharp meaning borders between ostensive names, there usually are sharp borders 'in nature'; and between

[17] Other alternatives are discussed in Tałasiewicz (2005).

e.g. green and yellow objects there is often no intermediary stage medium state (in a given situational context).[18] The relation of indiscernibleness 'stops' within the limits of the intended meaning (although in different situations it may stop at different 'points'; in artificially prepared situations there is no natural gap and a paradox appears: it turns out that the meaning of a given name/set of names that was given at the beginning does not match the description of a new situation).[19]

Cognitive psychologists (e.g. Clark 2003, p. 60 and n.) would stress human (and not only human) ability to automatically categorize a pseudo-continuum of physical data into classes of indiscernibleness of very narrow borderlines. Suppose – for illustration – that we have three sounds equally distant from each other with respect to some physical characteristics. Now, our cognitive apparatus is able to categorize them into two classes: two of them would sound the same for us, and be sharply distinguished from the third. Thus, not only the world, but we ourselves as well, although involuntarily, are responsible for breaking the indiscernibleness chains.

Another resource of disarming vagueness is to be found in relativity. Although theorists of vagueness do not stop warning that vagueness cannot be explained away logically by resorting to relativity, it is quite obvious that it is very often dealt with in practice by just such a strategy: 'Take a word like *soft*: What counts as soft for blankets or cuddly toys is rather different from what counts for skin, peaches, or mattresses. The same goes for *tall*: Whether something is picked out as tall depends on the surroundings. In a street of bungalows, a three-story house is tall, but the same house next to a skyscraper is not tall' (Clark 2003, p. 152).

3.2.3 Public Language and Private Language

Probably the most difficult and troublesome issue concerning this way of solving the problem of meaning is *the privacy* of language, or at least the part of language that includes primitive, observational names introduced ostensively. If the meaning of those names is co-determined by given instances, then at least at the deepest 'original' level it varies (for one name!) depending on what instances people have been shown. We could say there are no two people with the same set of instances, even for one name. No name (perhaps with a few exceptions) has one fixed ostensive definition. Every user of a language learns how to use a given name from different instances – the ones his teachers (usually parents) use at the

[18] Another issue, pointed out by Anna Wierzbicka, is that in different languages from the same typical instances (or the same kinds of instances – see below for this distinction) speakers would generalize to different sets: 'The closest counterpart of *bird* in […] Nunggubuyu does include bats, as well as grasshoppers […]; in Warlpiri [such an equivalent] excludes bats, but it also excludes emus […]. The prototype may well be the same in all these languages, but the boundaries are drawn differently' (2004, p. 464).

[19] I discuss this point more thoroughly in Tałasiewicz (2008a).

moment of speaking. Even twins may differ a lot in this respect – if one of them was shown one lemon in a basket and the other twin was shown another one. The meaning seems then to be something private – there are as many meanings of every name as there are people who use it. Such a meaning – at early stages of acquisition – appears to be relative to a particular ostensive procedure that happened to be used for introducing it.[20]

How is communication possible at all then? Where does public language come from? I suppose that public, conventional meaning is determined by making a sort of *idealization* and accepting a certain *hypothesis*.

We learn language all our life. Every new object that we are apt to accept as a designate of a given name is included in the meaning of this name, which changes constantly as a result. In fact, something like a single ostensive definition, except for special cases, does not exist. The process of 'defining' is an arduous one and new objects continue to be included as instances.[21] At some point we can say – and such *idealization* is not an irrational exaggeration here – that we have mastered the tacit rules of distinguishing those instances and that virtually each time we link a given name with the encountered object, we get it right and , more to the point, that we know all the designates of this name, even if only potentially. If this is true, there is no reason why we should not identify the meaning of a name with a pair where the first element is not a distninct set of instances but simply the whole denotation. Such a pair – following the solution discussed above – is simply a property expressed by a given name.

However, this solves the problem of the privacy of language only when, idealization apart, we accept a certain *hypothesis*. Every user of a language has to assume that the result of the idealization is the same for him and for other users – in other words, that the meaning is common.[22] Experiencing good communication proves this hypothesis to be true in most cases, for the development of private meanings of given words among different people is demonstrably convergent (Clark 2003, p. 153 and Bartsch 1998, p. 34).

The process is by no means easy and simple, though. It takes years; in fact we can never be quite sure if we already have the right meaning – or if there is a *right* meaning at all: 'Many speakers, for example, conceive of the meaning of the word *livid* as meaning red – to be livid is to be red with rage – while other speakers and most dictionaries take it to mean pale [...]. In this case, it is simply not obvious what the public meaning of *livid* is […].' (Johnson 2004, p. 85). Also, in artificially prepared situations, the hypothesis shows its limitations, e.g. in the paradox

[20] 'The context in which children first encounter a word may play an important role in the first meaning assigned and in how children subsequently go on to use that word. Here there are liable to be large individual differences' (Clark 2003, p. 153).

[21] For details see Clark (2002 and 2003).

[22] Most users of course will make this assumption unconsciously – they just act as if they were making it.

of vagueness, which shows how the use of colloquial expressions fails in certain contexts.

The concept of meaning presented here allows us to treat such difficulties, especially paradoxes of vagueness, not as logical but as pragmatic problems connected with an incorrect judgment of the situation by the user of the language. In case of such difficulties one simply needs to reject the hypothesis, acknowledge the idealizations of disagreeing users as incompatible, and negotiate in order to unify those idealizations (here at least one of the negotiating users has to change their private meaning of the incriminating expression).

3.2.4 Compound Names: Natural Kinds and Appearance Concepts

The denotation of a name in our approach is determined by an appropriate relation and instances in a such way that objects belonging to this denotation are those which stay in the given relation with the instances, e.g. denotation of the name ‘the colour of a lemon’ is determined as a set of objects of the same colour as a certain lemon.[23] This way of looking at the problem reveals an interesting complication concerning compound meanings, which spreads onto all prototype- or stereotype theories of meaning. This is because the simple solution that the meaning of a compound name is based upon a respective operation on relations constituting the meanings of the parts (the product of relations for conjunctive combinations, the sum for alternatives and the conversion for negations) does not work. It turns out that combinations like ‘yellow and round’ (let us call them the names of CP1 type) need to be distinguished from names like ‘the colour and shape of a grapefruit’ (names of CP2 type). In the latter case the same instance determines the denotation for both the relation of being the same colour and the relation of having the same shape. Here we can take the product of these relations and say that the objects belonging to the denotation of the compound are all and only those which have the same colour and shape as some grapefruit *a*. Quite the opposite is true in the former case: there can be different instance for the colour-relation and different for the shape-relation. There is no single instance to be connected with via indiscernibleness (or whatever relation) to make a denotation.

Let us take a closer look at those names. Only the names of type CP1 are in fact compound names. In this case the instance of the given colour is different (e.g. a particular lemon) than the instance of the given shape (e.g. a particular pool ball). The two relations cannot be unified into a homogenous mathematical entity and we cannot say that the denotation includes all those objects that are of the same colour and shape as…, exactly, we cannot say as what. The two relations have to

[23] For simplicity I return to the fiction of one instance here. In reality, here and elsewhere in this context we should always consider a set of instances and the determination of denotations should be appropriately adapted. I hope this shortcut will not cause any misunderstanding.

be kept separate: the denotation of the name 'yellow and round' inlcudes all and only those objects which are the same colour as the exemplary lemon and the same shape as the exemplary pool ball.[24]

Compound meaning must be represented by a system of pairs of the form $<A(\Phi_i), \boldsymbol{R}(\Phi_i)>$ together with the necessary mathematical operations. These operations however must be mentioned as additional information, outside the pairs <relation-instances>. Hence, the general form of the meaning of a name consisting of two names is: $<Z_1, Z_2, *>$, where Z_1 is the meaning of the first name, Z_2 – of the second one, and * stands for the operation that needs to be performed on the *denotations* (not relations) of both names in order to obtain the denotation of the compound name. The representation of the properties expressed has to be presented analogously.

Such a system, even though it is syntactically complicated, is logically very simple, and it has an important advantage. Namely, when used for meanings, it allows us to apprehend the compound meaning with only an intuitive knowledge of the component names' meanings (e.g. without recognizing exactly what relations are involved). And this is the most common situation: for the majority of natural language expressions we are not able to follow all the way from primitive expressions – which we believe to be the foundations of language.

Another important (and nice) consequence of our system is that the prototype- or stereotype kind of theory of names can be restricted only to names introduced ostensively. The meaning of a genuinely compound name (CP1) does not contain instances (whether prototypes or stereotypes) of the denotation of this name.[25] This observation helps to neutralize Jerry Fodor's complaint about the prototype theory of meaning. The author rightly points out (1998, pp. 101–102) that 'prototypes don't compose', and we cannot employ the prototype theory to explain compound, compositional concepts. If, for example, 'a cat' has a prototype (or stereotype), 'an uncat' (meaning: 'something that is not a cat', 'not-a-cat') does not (what could it be – a bird, a dog, a stone?). Our approach would accommodate this observation: the meaning of the name 'uncat' would be represented as <<the meaning of the name 'cat'>, complement>. There is no mention of any prototype or stereotype of an uncat.

Consider now the names of CP2 type – i.e. such as 'being like this object here with respect R_1 and R_2 and R_3,…'. They are based upon multiple relations, but their denotation is determined by just one object.[26] I believe then that they can be interpreted not as genuine compound names, but as simple, primitive names: 'a man' = 'being like Socrates here'.

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[24] A similar distinction is necessary not only for conjunctive combinations of names but any combination whatsoever.

[25] Indirectly, it contains instances of all primitive, ostensively introduced names used in the reconstruction of a given compound. But the user need not to be aware of this.

[26] More precisely: through one set of objects.

An analogous analysis can be given to *natural kinds* names. Positive and negative instances are given *explicite* in the definition; the respect and level of similarity have to be guessed. This time, however, unlike in the situation of names expressing simple properties, guessing those respects is far more complicated and we can say we never grasp all of them properly. But the practical advantage makes us pick out as natural kinds those categories of objects which we can successfully distinguish from others thanks to our perceptive apparatus. As a result, the vagueness of the names denoting natural kinds in actual use is probably even less troublesome than the vagueness of names expressing simple properties.[27]

The same is the case with the names of many popular artifacts, which are also defined ostensively, and generally with all the so called appearance concepts. Here we part with the tradition that tells us to distinguish sharply these two kinds of concepts: natural kind concepts and appearance concepts – and with its prominent adherent: Jerry Fodor. Fodor draws the distinction along the following lines:

In the designates of appearance concepts there is nothing in common except a special relation with our minds: 'what doorknobs have in common qua doorknobs *is being the kind of thing that our kind of minds [...] lock to from experience with instances of the doorknob stereotype*' (Fodor 1998, p. 137). Whereas natural kinds have many internal links: there are many laws of nature about water or electrons or cats, entirely independent from our minds.

This criterion at the first glance seems reasonable. There are reasons for not relying on it too much, though. For one thing, appearance concepts are not as mind-dependent as it would seem at first. There must be something in the very objects that interacts with our minds and influences them to categorize these objects in this way rather than in another. It can be a functional property, for instance (this is quite common for artifacts: doorknobs are for opening doors). Such a property is a relative one, no doubt, but it is relative *not to our minds* but to the role the given object is designed to play. Discovering such regularities is an important part of the 'research' that children do about the world and language, no less important than discovering the laws of nature.[28] On the other hand, natural kinds are not as mind-independent as Fodor would like to picture them. Surely, they are subject to laws that are applicable only to them (e.g. that water is chemically H_2O); there are however many laws binding larger or narrower classes of objects (like liquids in general – e.g. Bernoulli Law – or sea water: that you cannot drink it). And it is to some extent mind-dependent how broadly we understand the 'natural' kind (cf. also the discussion of the basic level assumption, above). The classic example is the difference between 'snow' in European languages, which denotes a natural kind, and 'snow' in Inuit, which does not. An Inuit would regard the laws concerning

[27] Fodor puts it very straightforwardly: 'If the world co-operates you can get concepts of natural kinds very cheap' (1998, p. 159).

[28] Among authors who stress that children categorize objects according to similarity *regardless* of whether this similarity concerns objective properties or rather some relations with the subjects themselves, is Renate Bartsch (1998, p. 9).

particular kinds of snow as more important than the laws for snow in general. The problem can be also viewed in terms of biological taxonomy, in the conflict between morphology and cladistics, where the kinds discriminated traditionally on morphological grounds (and thus in a sense according to the 'appearances' phenotype) are confronted with the taxa discriminated on the grounds of similarity of the genotype (the proximity in the evolution tree).

But first of all, it seems crucial to me that both kinds of concepts are acquired in precisely the same way: ostensively. Only a very advanced knowledge about the world may provide some grounds (not very firm, as we have seen) to persuade us that there is a trace of difference in the objectivity of concept determination in both cases.

Fodor comments on this argument from a historical perspective, taking Homer for a scientifically innocent mind (which is a great injustice to the guy, I would say). I would rather choose ontogenetic development and the perspective of a contemporary child (instead of an adult in the childhood of mankind). But this is perhaps not so important. Where we seriously part our ways is our view on what really happens at the very moment of enlightenment: at the moment when a child – or mankind – eventually finds out what is the genuine nature of a given natural kind. According to Fodor, the concept of a given kind remains the same, say: WATER. All men, ancient and modern (and contemporary children, let us add) are supposed to have exactly the same concept of water, whose metaphysical nature is defined by its chemical composition: H_2O. Of course, neither Homer nor twenty-first century kids are the least bit aware of it, because they acquire the concept by exposition to the appearance properties of water. But in historical (and personal, let us add) development, at the moment of enlightenment, says Fodor, suddenly changes the source of this concept: from everyday observation to scientific, highly theoretical research into the chemical composition. In the moment of scientific discovery there changes only the way of having this concept (Fodor 1998, p. 159). The concept itself remains unchanged.

I would put these things differently. It is exactly the concept that changes. There is on the one hand an appearance concept, given ostensively, and on the other hand a scientific concept, defined by a precisely determined essential property.

Of course, says Fodor, the first thing is the question: does what our mind conceives of uniformly behave uniformly with respect to other things? Is it subject to any laws that we can identify? This is a time-honoured philosophical question about the essence of things, which to us appear connected. We can thus ask – and should do – about the essence of all ostensive concepts – as soon as we reach the age (or a stage of historical evolution) at which we experience the urge to make scientific inquiries. With some concepts, upon inquiry, we will answer ourselves in the affirmative: water, for example, is H_2O. With others, the answer is NO: the essence of door knobs is of no interest to us (save for their function).

Where we suspect a concept to conceal some essence, we lay down a rule and create a new term – a technical term – which breaks away with our stereotypes

and comes to rely on a precise definition of the essence. Today most people believe this can be done for water, but not for doorknobs. However, at one end there are the defeatists among us who are so entrenched in their terminological relativism that they do not expect to find the essence in anything. At the other end there are the hurrah-optimists, who set out to discover the real nature of everything, including doorknobs.

Who is right? Isn't it just a dispute about terminology?

No, it is not, because both approaches: that of Fodor's and the one proposed here, have a different explanatory force in elucidating the use of terms, whether in everyday speech or in the language of science. It can be easily seen that we often use both terms: the everyday and the corresponding technical one. If, for example, walking along the Vistula river I notice a man drowning and cry out: 'Man in the water!', I don't mean 'water' in the sense of 'H_2O'. Moreover, even if Hilary came along, took a sample of the water, tested it, and declared that the Vistula's composition is not H_2O but mainly XYZ, my cry would still be true.

Actually, what flows in the Vistula river is not only H_2O but a mixture of many chemical substances, some of them quite exotic, perhaps. Hilary might say: OK, but most of the stuff is H_2O. Honestly, is this enough? The juice my daughter drinks consists in the main of H_2O. And yet, juice is not water. The difference is clear enough: Would you like some water? – No! I want juice! (There is even more H_2O in the tea I drink. Yet my daughter tells me, strictly in accordance with the linguistic convention and modern dietary guidelines: Don't drink so much tea. Drink more water.) Examples can be multiplied: do we not deny the common name 'fruit' to the rather obvious – from a scientific point of view – fruit: tomatoes, nuts, chestnuts and so on?

All this would not be possible under Fodor's approach, where there is only one concept to contend with. Thus, it is not the case, as we read on p. 159, that there is no 'technical concept of water'. There is. And that is what is important for the problem of conceptual changes in science. Contemporary theories of rationality of science attach great importance to shifts in terminology in the development of a scientific discipline. Every now and then it becomes apparent that the world could be conceptualized in a different way than it has hitherto been done. This can be achieved by adopting different natural kinds, contracting, expanding or shifting the scope of scientific concepts, of which Fodor's approach (concepts do not change as science evolves, only the way we conceive of them changes) cannot hope to give a proper account.

Similarly, his approach would run up against difficulties where objects which to us appear connected would not have a common metaphysical nature (doorknobs) but, unlike doorknobs, could be divided into, for example, two groups bound by objective laws. This would be the case if scientists were to discover that, say, apples did not have a common nature (what they have in common is that they appear the same to us) but that some of them were fruit indeed while others were only juice-laden widenings in branches belonging to an entirely different species (which to us are indistinguishable from the real fruit).

Or if it turned out that the chemical composition of some of the water samples was not H_2O but XYZ, as in Putnam's famous example. Fodor argues, after Putnam, that upon such discovery we would accept that XYZ was not water, even though it did look like water. However, the price we have to pay for letting our intuition take us down this route is setting the discovery in a different world, Twin Earth, and giving the whole thought experiment an air of mild absurdity (once we put ourselves in such a frame of mind, intuition becomes much more liberal: imaginings include light swords and Han Solo-like space raids …).

I am convinced that if chemists had recognized from the start that water samples were mixtures of H_2O and XYZ in varying proportions (including occurrence of either of the components in unadulterated form), both substances would have been called 'water'. Actually, a similar discovery was made about the air: air turned out to be a mixture of gases, except the proportions of one gas to another did not vary completely randomly. The proportions can however vary over a wide range, so wide in fact that it is difficult to define the essence of air by giving a percentage breakdown of its chemical composition. The proportion of each gas in the air, in particular the carbon dioxide content, can vary around the world by anything from several to well over 10 per cent.

It would not be linguistically odd to call the atmosphere of another planet 'air' just because it made breathing possible or had the required appearance property: the chemical composition would not matter much. In the end we continue to adhere to our approach, which does not acknowledge any logical difference between expressions referring to natural kinds and those connoting appearance properties.

3.2.5 Analycity and Quasi-Ostension

Pursuing some of the lines of inquiry suggested by the proposed definition of meaning shows that it does not depart markedly from the traditional conception: public meaning is usually a connoted property. Our approach however is now more refined than the traditional view and can help to explain successfully certain important problems.

It can in particular help to explain the cases of non-synonymy of names connoting the same properties, discussed at the beginning of this chapter. If public meaning is a result of a certain idealization of private meaning, then we can control it to some extent by setting the limits of the desired scope of this idealization. More specifically, we can consider the name 'yellow' to be a primary name, defined ostensively. It connotes the property of being yellow and its public meaning is the property of being yellow.

We can find, however, that the totality of yellow objects is too diverse and that the idealization which has us imagine all of them goes too far (the hypothesis of the same result being obtained by each speaker who idealizes in this way is too much of a fantasy; the likelihood of miscommunication is quite high). In such

cases we can do what the authors of *Webster's Encyclopedic Unabridged Dictionary* did, that is, give a quasi-ostensive definition (as I propose to call it) of a name: 'yellow – of a bright colour like that of butter, lemon, *etc*.'.

A quasi-ostensive definition requires that the first position of the structure representing name's meaning be occupied not by the whole denotation of the name but by a set of some typical natural kinds, indicated explicitly (here: butter and lemon fruit), which are believed to be graspable more easily than the whole denotation.[29] Idealization is thus limited to an assumption that we are able to generalize only selected designates, in particular those which belong to the indicated natural kinds. Of course, the property which is connoted by this over-defined name does not change. The public meaning, however, is no longer the same.

It is not identical to the property in question but constitutes a sequence <denotation of natural kind, relation pointed to>. This is what happens in the case of the names we have used earlier to illustrate our point 'the colour of a lemon' and 'the colour of a grapefruit'. The meaning of these names is not the property they connote (<denotation, relation>) but <appropriate natural kind, relation>, which in this case is respectively <total of lemons, sameness of colour> and <total of grapefruits, sameness of colour>. These meanings differ of course and are in turn different from the meaning of the name 'yellow'.

Quasi-ostension, which is notoriously common, throws some interesting light on the problem of analyticity. Let us take the sentence, 'The cat is an animal.' This sentence is analytic (if it is at all!) not because – as could be judged at first glance – 'cat' is defined by reference to 'animal' (as an animal species). This is not the way definitions are made; 'cat' is defined strictly ostensively ('cat', in our culture, is one of the first words acquired by children); 'animal' on the other hand is often defined quasi-ostensively, by naming as its representatives different animal species. In cases where 'cats' are mentioned, our sentence is indeed analytical. This is because 'animal' is defined by reference to 'cat', not the other way round, as was often held. [30]

Incidentally, it is worth pointing out that the origin of the common concept of animal is responsible for a considerable discrepancy between this term and its technical equivalent, learnt usually in the biology class at school. The animal kingdom is far too diversified for our cognitive apparatus, which makes the taxonomic assumptions (see Section 3.1), to generalize from the species commonly encountered by children (dogs, cats, squirrels, etc.) to the whole extension. That is why in everyday speech the concept of animal is very limited: often it does not cover birds or fish (word clusters like 'birds and animals' are used), and hardly

[29] Our definition is called an '-ostensive' definition because it explains the meaning by pointing to certain sample objects (here: natural kinds) which require further generalization. The suffix 'quasi-' is added to indicate that the objects that have been pointed to are not individual objects and that the pointing itself has rather linguistic nature. Thus, concepts that have been introduced in a quasi-ostensive manner cannot be of a primary type; they presuppose some linguistic competence.

[30] This does not apply, of course, to zoological definitions given in science.

ever invertebrates. For such reasons a sentence in everyday speech such as, ‘The mosquito is an animal,’ is not analytic but contains new, and to many quite surprising information.

Our approach explains how a great many names, including names of natural kinds, can be defined ostensively. Yet it admits the possibility that any of those names could be defined non-ostensively (by means of other names – already ostensively defined). This in turn makes it possible to acquire linguistic competence within a system where the ostensive resources of a language are highly individuated: what is defined ostensively to some people (and is a logically basic and simple concept) is to others defined non-ostensively (and is a derived, complex concept).[31]

We are further enabled to explain another problem which is cited by Fodor in his attack against the stereotypic theory of meaning: the so called *pet fish problem*. Fodor makes an observation (1998, p. 102 and the following pages) that the stereotype *pet fish*, say, goldfish, is different from the stereotype *fish*, such as trout, and from the stereotype *pet*, such as cat or dog. From this he concludes that since *pet fish* is a combination of *pet* and *fish*, then either the meaning of compound words is not compositional or meaning as such cannot be a stereotype at all. And since there are good reasons to preserve compositionality, meanings are not stereotypes.

In keeping with the approach proposed here, we are faced with an disjoint alternative: the expression *pet fish* is either compound or has a stereotype, depending on a speaker’s experience of its acquisition. Some people have learnt the meaning of this expression aided by a normal definition: on hearing the expression they asked about its meaning and were told that a pet fish is a fish which is kept in a fish tank at home. This way of acquisition makes it a compound and compositional expression (it has the form <<fish>, <household animal>, $\cap$>), without a prototype or stereotype. Others will have seen a fish tank and the goldfish swimming in it first.

On asking what it was they were told: *pet fish*. For them, the expression *pet fish*, despite being syntactically compound, is a logically and conceptually basic one, and has an ostensive meaning, that is, a prototype/stereotype. The generalization and idealization mechanism conspires to make the public meaning of *pet fish* largely independent from the process of its acquisition, even though the subtleties of meaning may continue to make themselves felt (a practical joke might involve giving a small shark or a piranha fish to a person who has asked for a pet fish for their birthday present).[32]

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[31] This may amount to the relativisation of Langacker’s *basic domains* – ‘cognitively irreducible representational spaces of fields of conceptual potential’ (Langacker 1991, p. 4). Perhaps we cannot do without such domains (our discussion about ostensive procedure would rather support their assumption), but we cannot exclude the possibility that different people can – in principle – have different domains as basic.

[32] Interestingly, Fodor himself reasons in a similar way (1998, pp. 164–165) with respect to a red square: he observes that the expression can be a compound (in which case knowing the concept

The proposed approach offers a way out of Fodor's dilemma. Fodor emphasizes that meanings cannot be stereotypes or prototypes and that they can only be properties (Fodor 1998, p. 107, Chapter 5). Elsewhere in the same book he admits that '*Pace* Chapter 5, concepts should in fact be stereotypes' (p. 138). His admission is well-founded because his whole line of reasoning dedicated to primary concepts (thus ostensive concepts) inevitably leads to such a conclusion. Unfortunately, he does not discuss this contradiction in the rest of his work nor does he refer to it at all, so it is hard to speculate on how he proposes to get around it. As has hopefully been shown, our approach helps to avoid the contradiction.

At the stage of acquisition, primary concepts in a private language (meanings of expressions defined ostensively) are built from, among other things, designates. Putting the technical aspects to one side, we can treat them, roughly speaking, as prototypes/stereotypes. Fully-fledged concepts, including public concepts and compounds, are not stereotypes. They are properties, as Fodor would have it. [33]

From the syntactic point of view, perhaps the most interesting aspect of the proposed ostensive meaning conception is the admissibility of syntactic compounds, such as *pet fish* or *red square*, as primary concepts: capable of being understood directly without a syntactic analysis. Thanks to this possibility, we can define ostensively sufficiently many names to create a database for the whole semantic category, especially that any string of words can in fact be the definiendum in the ostensive procedure. For example, '[here is a] big dog,' and '[here is a] good girl.' Once we know the category of the expression 'dog' and 'big dog', we can infer (by means of the atomic principle applied in reverse) the category of the functor 'big'. [34]

There remains as yet the most important question: what about sentences? Can we define sentences ostensively? The sentence category is commonly thought to be of the basic type. It must be possible for sentences, at least some of them, to be defined ostensively; otherwise there would be no way of assigning them a category

of being red and the concept of being a square is necessary for the acquisition of the expression), or one which is basic, primary, learnt ostensively by discovering red squares. Red squares can then be comprehended without any knowledge of red objects or squares taken separately. Fodor uses this observation to explain how it is possible for names such as 'red square' to be primary names but why, despite the apparent analogy, names such as 'round square' are not. The analogy lies in the fact both type of name can be compound; contradictions however can only be compounds – they have no designates by means of which they could be defined ostensively and thus regarded as primary concepts (I have arrived at similar conclusions in analyzing contradictory properties (Tałasiewicz 2005)). Unfortunately, Fodor fails to spot that the same argument applies to the problem involving the expression *pet fish*, which, just as *red square,* can be regarded as either a simple one, with a stereotype, or as one which is compound, compositional and without a stereotype.

[33] We can fully agree with Wierzbicka's remark: '[I]t is crucial to understand that there is no conflict between prototypes [or stereotypes] and definitions' (Wierzbicka 2004, p. 470).

[34] Careful: the word 'big' can itself be defined ostensively – it then belongs to a name (*n*), not a functor (*n/n*) category!

up-front (without this option – in the light of our earlier considerations – we would not be able to get on with a syntactic analysis of any natural language).

3.3 Sentences

In order to consider ostensive definitions of any sentences, we must be clear about what object correlates of sentences are.[35] Unlike with names, where it is universally agreed that at least some designates are things, denotation of sentences is far from being a settled issue. Two views clash head on here: the view that the denotation of a sentence is its truth value, and the view that its denotation is a state of affairs which the sentence describes (situation).

Frege's semantics (*On Sense and Meaning*, 1980b) was the first of modern semantic theories. Frege argued that the denotation of a sentence is its truth value. His views represent the established view, to which all other conceptions must look back. Frege's semantics holds the historical pride of place, and it is up to his rivals to demonstrate their supremacy. Their shortcomings are Frege's strengths. Another reason why the truth-value theory of sentential denotation holds sway is that such semantics is simple and perfectly integrated with the model theory.

The first of these two claims is not overly strong. It is an argument from history, not from science. One only needs strong intuitions to the contrary in order to deny its merits. The second claim is not entirely independent from the first. In the 1930s, when the model theory was put forward, Frege's semantics had the field to itself (Husserl did no more than allude to the topic, while Wittgenstein's *Tractatus* (1922) had not yet gained wide acceptance). Trying to make model theory work with Frege's semantics is somewhat like making a new Intel processor work with Microsoft Windows. Proponents of situations are where Linux or Apple users are today: they have found themselves on the wrong side of the (not necessarily the best) market standard.

Interestingly, Frege's theory admits, it seems, states of affairs or situations:

- Frege's main postulate (MP): If in a sentence we replace one word with another word that has the same reference, the reference of the sentence must remain unchanged
- [*enthymematic postulate which Frege does not defend*] There are only two candidates for sentence reference: proposition (thought) and truth value
- Propositions do not satisfy MP

Ergo: the reference of a sentence is its truth value

As can be seen, situations can in fact satisfy Frege's MP and may have simply not occurred to him at the time. To this extent, Frege's arguments are not a decisive

[35] Some ideas included in this chapter were originally published in my paper (Tałasiewicz 2008b).

voice in the dispute with situational semantics. Indeed, Husserl (2001) believed that it is situations that are the semantic correlates of sentences (cf. e.g. LI, I, §12; V, §36). Next, Wittgenstein proposed his version of situational semantics in *Tractatus logico-philosophicus*, and one followed until today by the group of Polish logicians including Roman Suszko, Bogusław Wolniewicz, Mieczysław Omyła, Anna Wójtowicz and Andrzej Biłat. Finally, in 1983 Jon Barwise and John Perry published *Situations and Attitudes* – a book which opened completely new horizons in situational semantics. The price we have to pay for Wittgenstein-Suszko's formal elegance in semantics is a highly counter-intuitive treatment of elementary situations – 'unheard of by a human ear and unseen by a human eye,' as one of the commentators has said.

At any rate, there is no simple translation of Wittgenstein's situations into anything that could be regarded as a correlate of an ordinary sentence in natural language, along the lines of *The cat is on the mat*. The same can't be said about Barwise and Perry's: 'We are always in situations; we see them, cause them to come about, and have attitudes toward them' (1983, p. 7). 'Real situations are not sets, but parts of reality. They are perceived and stand in causal relations to one another. They comprise what might be called the causal order' (1983, p. 58).

And this is exactly what we want and what we need. Let us put aside our intuitive objections against that all true (or false) sentences have the same object reference – enough has been said about it.

The most important thing is that perceptible concrete situations can serve as objects pointed to in the ostensive definitions of sentences, which is necessary if we want the conclusions we have reasoned to in this book to be correct. Our considerations thus boil down to the claim that we need two different semantic categories which must be learnable ab initio, without a prior knowledge of the language; hence, defined ostensively. Husserl's intuitions suggest that names and sentences will answer our purpose, and both must possess at least some concrete designates.

Adopting such semantics will open the way to the ostensive definition of sentences and give us a fresh look at a host of other problems. We will be able to work out a non-extensional definition of relations, define sentence meanings, tackle the problem of intensionality (which is what Barwise and Perry had originally set out to do), and finally come up with a radical solution to the problem of quantification. The last of these in particular has hitherto been the bogeyman of categorial grammar, as noted in Section 2.2.3.

The source of the problem, as we have seen, is that categorial grammar assigns the category of sentences to sentential functions, whereas they cannot have sentential semantic correlates, if the correlates are to be truth-values. Thus, typically, sentential functions are supposed to have predicate-like extensions as correlates. While being sentences for grammatical purposes, semantically sentential functions seem to behave as predicates. Therefore, quantifiers, which make sentences out of sentential functions, are ambiguous between *s/s* – syntactically, and *s/(s/n)* – semantically (neither of which seeming satisfactory, for various reasons). Now, situation semantics gives us new opportunities to solve (or rather dismiss) the

dilemma. Sentential functions can denote some generalized situations, insufficient by themselves to establish the truth-values; quantifiers can be devices for specifying the conditions that must be fulfilled by such situations to license the truth or falsity of respective sentences. We will discuss this in greater detail further.

3.3.1 Standard Theory of Situations

As I have said, I would resort to the sort of theory like the one developed by Barwise and Perry (1983). However, many details of this theory were introduced in order to reflect the pragmatic context of a sentence. I am not interested in that here. Therefore, I'd rather use a simpler version of Barwise-Perry's theory proposed by Ryszard Wójcicki (1984, 1986). The notion of a situation introduced by Wójcicki corresponds to Barwise-Perry's notion of a *constituent sequence*. In order to become a B&P-situation, a constituent sequence needs to be supplemented with a factual indicator (holds/does not hold), a space-time location, and many additional parameters characterizing extralinguistic aspects of the given statement. I will not take this into account – it should not however undermine the general validity of the following considerations. On the contrary, it will hopefully make our discussion more clear.

Let the structure ($\mathbf{U}, \mathbf{R}_0, ..., \mathbf{R}_m$) be a model of a given language; where **U** is the universe and $\mathbf{R}_0, ..., \mathbf{R}_m$ are (expressible in the language) relations on **U** ($\mathbf{R}_0$ is identity on **U**). *An elementary situation* is a string ($\mathbf{R}_i, \mathbf{a}_1, ..., \mathbf{a}_{j(i)}$) such that $\mathbf{a}_1, ..., \mathbf{a}_{j(i)}$ are elements of **U** and $j(i)$ is the arity of a relation $\mathbf{R}_i$. Such a string is a correlate of an atomic sentence $R_i(a_1, ..., a_{j(i)})$, where R_i is a predicate denoting $\mathbf{R}_i$, while $a_1, ..., a_{j(i)}$ are names of objects $\mathbf{a}_1, ..., \mathbf{a}_{j(i)}$. A situation $s_1 = s_2$ (identity of two situations *tout court*) is also an elementary situation.

A precise definition of a *situation* (*tout court*) is rather complicated. To make it clear, let us start with an example. The situation which is described by the sentence 'Amy has Kitty' is elementary and of the form (**has, Amy, Kitty**). The situation described by the sentence 'Emily has Tigger' is elementary and of the form (**has, Emily, Tigger**), and so on. The situation that corresponds to the sentence 'A girl has a cat' could be the set of all such elementary situations. Naturally, we can characterize analogously the correlate of the disjunctive sentence: 'Amy has Kitty or Emily has Tigger'.

A definition of a situation as a certain set of elementary situations is not sufficient in general. It does not take into account situations that include complex relations or correlates of conjunctive sentences. Let us consider the sentence 'Johnny is screwing this bolt'. Assume that in a given model there is no relation of screwing,

and screwing is understood as a composition of pushing and turning.[36] Then the situation described by the sentence ‘Johnny is screwing this bolt’ is the set consisting of the two elementary situations {(**pushing, Johnny, this bolt**), (**turning, Johnny, this bolt**)}.The situation described by the sentence ‘A man is screwing a bolt’ is the family of all such 2-elements sets. Intuitively, this situation ‘holds’ if at least one set of this family consists of elementary situations that are both facts.[37] Therefore, every situation can be regarded as an ‘ontological’ disjunction of conjunctions of elementary situations. In other words, a situation *tout court* is not a set of elementary situations, but it is a *family of sets* of elementary situations.[38] Formally, an elementary situation is not a situation *tout court*, but we can find a way out of this strange predicament: if s is an elementary situation, then $\{\{s\}\}$ is a corresponding situation *tout court*.

3.3.1.1 The First Modification

The theory presented above very briefly has many advantages. However, considerations in the preceding parts of the present book force us to introduce some modifications (since the standard theory defines a structure of a situation in terms of a structure of an atomic sentence, we are explicitly engaged here in the theory of syntax). Below we present the first modification

According to the standard theory, a relation R_i that links objects occurring in a given elementary situation is a constituent of this situation. This relation is referred to as a correlate of a predicate R_i occurring in a corresponding atomic sentence. However, according to categorial grammar, the relation that associates objects occurring in a given elementary situation (objects correlated with nominal phrases of a given atomic sentence) *is not* usually a correlate of a corresponding predicate.

In categorial grammar, functors (predicates and adverbials in particular) denote special functions that assign the denotation of a given compound expression to the denotations of the functor’s arguments. We have called such functions ‘Ajdukiewicz functions’. For example, Ajdukiewicz functions corresponding to predicates assign the denotation of a given sentence (that is a situation) to designates of names, while Ajdukiewicz functions corresponding to adverbials (that is predicate-functors over predicates) assign the denotation of a compound predicate to denotations of predicates (that is to some Ajdukiewicz functions; see Ajdukiewicz 1978). It is easy to see that such functions are not in general relations between the designates of a functor’s arguments. For example, in the sentence ‘Amy is stroking

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[36] Indeed, Barwise and Perry indicate that we can distinguish relations which hold in a model directly, as well as relations which do not (see Barwise and Perry 1983, p. 76).

[37] We will say more about truth-conditions in one of the subsequent sections of this chapter.

[38] All elementary situations belonging to these sets contain the same objects.

Kitty' the denotation of the functor 'is stroking' is not the relation of stroking that holds between Amy and Kitty.

According to the notation used above, let us represent the relation of stroking by italics **is stroking** (though the second modification presented in the next section will show that this notation is a bit over the top) and the designate of a corresponding functor – a certain Ajdukiewicz function – by $(\textit{is stroking})_{\mathrm{Ajd}}$. The semantic structure of the sentence 'Amy is stroking Kitty' consisting of two names and a 2-place predicate can be presented as follows:

{{(**is stroking, Amy, Kitty**)}} = $(\textit{is stroking})_{\mathrm{Ajd}}$ (**Amy, Kitty**)

On the left side of the above equation we have a situation – the denotation of a sentence, while on the right side we have an Ajdukiewicz function with its arguments. In this case both arguments as well as the situation (elementary) are perceptible concrete facts, so they could be used in ostensive definitions of corresponding expressions. Therefore, to understand the sentence 'Amy is stroking Kitty' we do not need to know anything about the meaning of the functor 'is stroking'. The meaning of that sentence can be easily 'seen'. On the contrary, we can find out the denotation of the functor 'is stroking', because we understand the meaning of that sentence and we know the denotations of the names 'Amy' and 'Kitty'. The denotation of this functor is, of course, the function which assigns the situation of stroking Kitty by Amy to Amy and Kitty.

Stroking is on its own a metaphysical relation between Amy and Kitty, and its status depends on details of a given ontology. If, for example, we consider these to be elementary situations, then their correct representation will be the simple symbol 's'. The internal structure of a situation, in particular the relation 'is stroking', is only a derived result obtainable from abstracting many situations. The function $(\textit{is stroking})_{\mathrm{Ajd}}$, on the other hand, is a language relation, constituting the structure of a sentence – not necessarily the metaphysical structure of a situation (though it is, of course, a relation between objects and situations, not between expressions). It is, so to speak, a relation between objects and situations with respect to how we conceive of them, a relation constituting the structure of a linguistic conception of a given situation, not the situation itself. [39]

This example shows clearly, I hope, that the denotation of a functor is not the same as the relation between its arguments, although a certain regularity does obtain here: the function $\textit{is stroking}_{\mathrm{Ajd}}$ always assigns the situation {{(is stroking, A, B)}} to a pair of objects A and B – provided that our ontology is capable of exposing the internal structure of the elementary situation. The difference will be highlighted again later in the chapter as we discuss predicate modifiers (adverbials and verb complements). Such modifiers always interact with the Ajdukiewicz function, but in elementary situations (hence in relations between their components) often produce no discernible effect.

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[39] Using a loose analogy, we can hazard a statement that Ajdukiewicz functions have something of Kant's transcendentalism: they are a subject-based way of comprehending objective reality.

The reader accustomed to the Fregean tradition may now be confused. After all, it is generally accepted that models of the classical predicate calculus are relational structures in which relations corresponding to predicates occurring in atomic sentences are identified with relations that hold between designates of names occurring in these sentences. Where does this difference come from?

The source of the difference lies in the fact that in classical logic, i.e. in the Fregean version of the predicate calculus according to which denotations of sentences are identified with their truth values, there is a one-to-one mapping between the set of Ajdukiewicz functions corresponding to predicates and the set of relations between designates of nominal arguments of those predicates. Therefore, it is immaterial which set is chosen. The set of relations between designates of names is more intuitive; thus usually this set is chosen.

Let us look at the idea of this mapping by way of example.[40]

Let us denote the set of Ajdukiewicz functions for predicates by **A** = $X^{Y1\times\ldots\times Yn}$, where X is a set of semantic correlates of sentences, and Y_1, ..., Y_n are sets of correlates of nominal arguments of functors; *n* is the number of a functor's arguments. In simple cases, the exponent of this expression can be replaced by an *n*-ary cartesian product of the universe U.

Denote now the set of relations between correlates of nominal expressions by **B** = $2^{Y1\times\ldots\times Yn}$ (this is a family of sets of ordered *n*-tuples of elements belonging to Y_1, ..., Y_n – that is: ordered *n*-tuples of elements from the universe, in simple cases).

Both sets **A** and **B** are essentially different objects of set theory. Usually they are not of the same cardinality. They are of the same cardinality only if the set X of correlates of sentences has two elements. Then the one-to-one mapping from one set to another can be constructed by the so called characteristic function.

In our example, we present only denotations of unary predicates (*n*=1) in the case when the universe has 3 elements (U = {a, b, c}). Therefore, if we assume that X = {0, 1}, then the set of all Ajdukiewicz functions is:

A = { {(a, 0), (b, 0), (c, 0)}, {(a, 0), (b, 0), (c, 1)}, {(a, 0), (b, 1), (c, 0)}, {(a, 0), (b, 1), (c, 1)}, {(a, 1), (b, 0), (c, 0)}, {(a, 1), (b, 0), (c, 1)}, {(a, 1), (b, 1), (c, 0)}, {(a, 1), (b, 1), (c, 1)}.[41]

If we assume additionally that the value 1 informs us that an element belongs to a given subset, and the value 0 excludes it, then the range of the set **A** is the following set (the order of arguments of the function is preserved):

{∅, {c}, {b}, {b, c}, {a}, {a, c}, {a, b}, {a, b, c}}.

Therefore, this is a family of all subsets of the universe, that is, the set **B** of all unary 'relations' (*scil.* properties) that can be defined on the universe.

As we see, the assumption of Fregean logic (X = {0, 1}) according to which relations between designates of names are denotations of predicates is quite reasonable. However, such an approach is not admissible whenever sentences may have

[40] General presentation in Suszko (1960, p. 70).

[41] For example, a function {(a, 0), (b, 0), (c, 0)} is an Ajdukiewicz function that corresponds to a predicate forming a false sentence with a name of any object from the universe.

more than two different denotations, which is the case in situation semantics, as well as in many-valued logics. Let us note that if the set X of denotations of sentences has at least 3 elements, then the corresponding sets **A** and **B** do not have the same cardinality. The set **B** from our example remains the same – it's a family of all subsets of the universe. But the set of all Ajdukiewicz functions has 27 elements.[42]

3.3.1.2 The Second Modification

The second modification is connected with the assumption mentioned above: some situations are perceptible – in contrast to abstract relations – therefore they may be taken as primitive. Relations can be abstracted from situations and objects occurring in these situations. Hence, it seems awkward to define a situation as a string containing an element being ... a relation (though the objection of vicious circle is perhaps too strong).

In order to improve our formulation of the definition, I propose the following definition:

Any elementary situations σ_1 *and* σ_2 *are equal relative to a relation, written* $\mathfrak{R}_r(\sigma_1, \sigma_2)$ *for short, if and only if* σ_1 $(\mathbf{b}_1, ..., \mathbf{b}_i / \mathbf{a}_1, ..., \mathbf{a}_i) = \sigma_2$*, where* $(\mathbf{a}_1, ..., \mathbf{a}_i)$ *and* $(\mathbf{b}_1, ..., \mathbf{b}_i)$ *are sequences of objects from situations* σ_1 *and* σ_2*, respectively, and* σ_1 $(\mathbf{b}_1, ..., \mathbf{b}_i / \mathbf{a}_1, ..., \mathbf{a}_i)$ *is the situation obtained from* σ_1 *by replacing all of its objects by corresponding objects from* σ_2*.*[43]

Note that both σ_1 and σ_2 as well as the situation σ_1 $(\mathbf{b}_1, ..., \mathbf{b}_i / \mathbf{a}_1, ..., \mathbf{a}_i) = \sigma_2$ are elementary situations and theoretically they are perceptible objects, at least in some cases. If $\mathbf{b}_1, ..., \mathbf{b}_i$ and $\mathbf{a}_1, ..., \mathbf{a}_i$ are material objects, they are also perceptible. Therefore, there are reasons to expect that $\mathfrak{R}_r$ would not be completely unspecified.

If this is so, then relations between objects in situations, denoted by bold **R**, can be meant as the *equivalence classes of the relation* $\mathfrak{R}_r$.[44] For the sake of convenience, we will use the already introduced notation. However, it is necessary to remember how we obtained **R**: situations are primitive, relations are not. In further

[42] Amongst writers who apparently were confused by this issue was David Lewis. In (1970) he notices the difference between Ajdukiewicz functions and relations between denotations of a functor's arguments. However, he states that they (*scil.* respective functions and relations) are essentially different types of meaning. Lewis calls the first one *compositional meaning*, and the second one *Carnapian meaning*. We showed that the second meaning is a special case of the first one for use in Fregean semantics.

[43] We assume that the identity of objects in situations does *not* determine in general the identity of these situations. The situation that Amy is stroking a cat differs from the situation that Amy is kicking a cat. The identity of objects entails the identity of situations if and *only* if the situations in question are equal relative to a relation.

[44] The relation $\mathfrak{R}_r$ is interpreted traditionally: as in set theory.

sections, this will be very important for the definition of an ostensive meaning of a sentence.

It should be also noted that the above definition of relations permits us to get rid of the counterintuitive extensionality of relations (two relations that hold between the same objects are indistinguishable), unavoidable in the case of the traditional definition according to which a relation is a set of ordered n-tuples of its arguments. Our definition of relations as the equivalence classes of identity of situations in some respect allows us to distinguish two relations that hold between the same objects, provided that after the appropriate substitution the corresponding situations are not always equal. This is a very useful result, especially when we realize how many efforts were made in order to establish the discernibleness of co-extensional properties (*e.g.*, see Stanosz 1970).

3.3.2 Ostensive Meaning of a Sentence

Let us now see how elementary situations pointed out in an ostensive definition of a sentence lead to the denotation of that sentence as characterized above. However, we should remember that not every sentence can be ostensively defined. The method presented below is not applicable in every case. We assume here that only simple sentences are defined ostensively (and then only some of them). In order to avoid complicating the non-elementary situation which is the denotation of a sentence too much, we assume (contrary to the more general account above) that it can be at most a set of elementary situations and that intuitively speaking these elementary situations share a common relation. (*Nb.* the denotation of a simple sentence need not be an elementary situation! The sentence ‘A girl has a cat’ is simple, but it does not correspond to any elementary situation. The names ‘a girl’ as well as ‘a cat’ are general, while elementary situations are correlates only of those sentences that assert a relation between individual objects).[45]

Intuitively: the ostensive meaning of a sentence is <a pair consisting of <a string of elementary situations pointed out as ‘prototypes’> and <equality relative to the (relation that holds in each prototypical situation between objects)>>.[46] All

[45] Situations that correspond to compound sentences are more complicated. I do not set out to decide whether the ostensive definition of such complex structures is completely *out of the question*. Anyhow, surely it is very rare, and full characterization of the appropriate procedure would require more studies. Such an approach would require, among other things, revising the definition of a nonelementary situation. Thus a nonelementary situation should be defined as a set of *strings* of elementary situations rather than as a set of sets of elementary situations. The order of elementary situations in the strings would be relevant in determining the equations that hold between corresponding elementary situations of each string.

[46] A certain simplification of terminology is involved here. As we said, elementary situations are not elements of whole situations. They are elements of elements. In the case of situations-correlates of simple sentences, elementary situations are the only elements of those elements. Thus the simplification consists in omitting double parentheses.

elementary situations contained in the denotation of the sentence ‘A girl is stroking a cat’ have the form (**is stroking, a girl**$_i$**, a cat**$_i$). They differ in girls and cats, but in the first approximation, they do not differ in the relation of stroking.[47]

Having such assumptions, we can define the ostensive meaning of a simple sentence as a pair $<\{\sigma_1, ..., \sigma_n\}, \mathfrak{R}_r>$, where $\sigma_1, ..., \sigma_n$ are elementary situations pointed out as prototypes, and $\mathfrak{R}_r$ is the equality relative to a relation. For convenience let us assume the fiction of one prototype: $<\sigma, \mathfrak{R}_r>$

This meaning, very simple in itself, determines the denotation in a quite complicated way. Namely, the resulting denotation consists of all such elementary situations that have the form ($|\mathfrak{R}_r|_\sigma$, $\mathbf{a_1, ..., a}_{i(\sigma)}$), as well as of those which are in the relation of chain-indiscernibility $\mathfrak{R}$ with these situations. In this formula, $|\mathfrak{R}_r|_\sigma$ – the equivalence class of equality of situations relative to a relation – represents the relation between objects from the prototypical elementary situation that is intended to hold between objects in all elementary situations of the denotation under construction, while $\mathbf{a_1, ..., a}_{i(\sigma)}$ is any sequence of objects satisfying the following conditions: (a) the number of elements of this sequence equals the number of objects in the prototype situation; (b) every element in this sequence is an object *of the same kind* as the corresponding object in the prototype situation.

Condition (b) can be understood properly if we take into account that even sentences definable ostensively can contain general names already defined. This is so in the case of the sentence ‘A girl is stroking a cat’. The ostension is needed to point out the situation that someone is stroking something. However, it may already be known what a girl is and what a cat is. So the denotation of this sentence does not contain every situation in which someone is stroking something, but it contains only those situations in which some girl is stroking some cat, i.e. it consists of only those situations whose first arguments are objects of the kind GIRL (designates of the name ‘a girl’), while the second arguments are objects of the kind CAT (designates of ‘a cat’).

In the definitions of sentences as well as in the definition of names, a very important role is played by the so called *quasi*-ostension. In *quasi*-ostensive definitions, instead of concrete single prototypes (elementary situations) we use nonelementary patterns included in the situation in question. For example, we can define ‘an animal’ as ‘a cat, a dog, a squirrel, a horse or a cow, and so on’. Similarly, the sentence ‘somebody is touching someone’ can be defined by specifying the *kinds* of touching: somebody is touching someone means that somebody is

[47] The second approximation shows that the prototypes are usually not exactly equal relative to the relation in question but only similar (such a restriction is a standard one in the theory of ostensive definitions of names). Girl A is stroking cat A with the tips of her fingers, while girl B is stroking cat B with her full hand. One girl is stroking a cat’s head, the other one – its back. One is stroking quickly and roughly, the other slowly and gently. If we replace the equality by the similarity or by the chain of indiscernibleness, then the problem of vagueness appears immediately: there are many ways of stroking, and some of them are hardly distinguishable from scratching, squeezing, wiping, and even hitting. This problem can be solved in the same way as it is solved for names.

stroking, hitting, scratching someone, etc. This makes it possible to distinguish analytic sentences: ‘if x is hitting y, then x is touching y’, etc (the non-elementary situation correlated with the sentence ‘x is hitting y’ is included in the non-elementary situation correlated with the sentence ‘x is touching y’). *Quasi*–ostension can cause systematic ambiguity of some sentences: the general meaning *vs* the complementary meaning. In the above given example, touching, quasi-ostensively defined, has a general meaning. The similarity class including various kinds of touching suggests that we have to take into account any physical contact. However, in some cases the other meaning of touching should be admitted: namely, a *non-specific* physical contact that is neither hitting nor scratching nor stroking nor any other kind of touching specified in the *quasi*-ostensive definition. We refer to such a meaning as a complementary meaning. It also allows us to capture some analytic relationships different from the relationships appearing in the case of a general meaning. In such a case the sentence ‘if *x* is hitting *y*, then *it is not true that x* is touching *y*’ is analytic. The context of a sentence often determines which meaning is intended. When we say ‘Blushing, Mary touched Fred’s hand’, we mean a rather complementary meaning: we do not mean that Mary hit or scratched Fred. But if we catch a young boy in a fight and yell out: ‘Don’t you dare touch him again’ – we have in mind the general meaning: the injunction against touching includes also (and above all) hitting. The presented ambiguity should not be dangerous for our theory, since we have good tools with which to grasp and render it harmless (it suffices to distinguish *explicite* both meanings). But if we ignore this point, it may lead to confusion and difficulties in the intuitive understanding of analyticity.

The above procedure for finding a denotation of a given sentence by means of prototypes pointed out in the ostensive definition of that sentence is obviously very simplified. Apart from the simplification mentioned above (restriction to simple sentences), there are other simplifications. It seems that the set of all ostensive definitions can’t be sharply divided into two disjoint sets of definitions of names and definitions of sentences. Certainly, in many cases sentences and names occurring in sentences are defined simultaneously. The description of the real process of the ostensive procedure, with all of its nuances, is a task that goes beyond the scope of the present book – a task which has in fact a highly interdisciplinary character.

3.3.3 Non Ostensive Meaning of a Sentence

The meaning of a non-ostensive sentence is a structure consisting of situations belonging to the ostensive base and arranged according to the actual syntax of the

sentence.[48] For better understanding how it works, we shall first examine how one can acquire the syntax of a complicated yet still ostensive sentence:

The boy who is standing in that corner is looking at Amy.

The *elementary situation* (sic!) which corresponds to this sentence is as follows:

(S1) (**is looking at, the boy who is standing in that corner, Amy**).

The name:

(N) 'the boy who is standing in that corner'

designates exactly one concrete boy. It is built from the sentence 'a boy is standing in that corner' and the functor 'who' (a sort of reificator, of category *n/s*).[49] This sentence corresponds to a *nonelementary situation*:

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[48] It follows that in syntactically different languages intuitively synonymous sentences would have different technical meanings. In the language of the predicate calculus, for instance, the sentence 'A ginger cat is yawning' should be represented as $\exists x\ [C(x) \wedge G(x) \wedge Y(x)]$. However, such a representation loses some subtleties that are very important in natural languages. Namely, in this sentence the expression 'is yawning' is the only predicate *sensu stricto* (this is a sentence-forming functor with nominal arguments), while 'ginger' is a qualifier (name-forming functor with nominal arguments) and 'a cat' is a general name. It is indeed possible to characterize the denotation of the above sentence by means of predicate calculus: {{(**cat, object A**), (**ginger, object A**), (**is yawning, object A**)}, {(**cat, object B**), (**ginger, object B**), (**is yawning, object B**)}, ...}; however, it can also be done by means of the syntax of the natural language: {{(**is yawning, ginger cat A**)}, {(**is yawning, ginger cat B**)}, ...} – where every elementary situation is based on the yawning of a certain ginger cat. The idea is that we want to distinguish what we say about a concrete object from how we say it and how we specify this object. In the above example, every representation **ginger cat A**, **ginger cat B**, and so on, corresponds to a fixed object, and hence the corresponding situations are elementary. The only complicated and syntactically complex thing is the linguistic way of indicating this object (by means of a general name and a qualifier). Of course, if we were not in direct contact with this elementary situation that actually is a fact and in virtue of which the sentence 'A ginger cat is yawning' is true, then the interpretation of this sentence would require at some stage a 'decoding' of the syntactically compound name 'a ginger cat'. But it is not the stage of identification of the situation *tout court* corresponding to the whole sentence that has the structure {{(**is yawning, x**)}, {(**is yawning, y**)}, …}. According to categorial grammar's terminology, it will be a different *level* of analysis. On this other level, we will have to establish the denotation of some compound name. If this name has exactly one designate, we need to establish what it is. If it is general, what is its extension. This approach suggests that general names are neither pure variables nor singular names of some sets, but they are meant rather as variables *together with their ranges*. So the name 'a ginger cat' should be semantically represented as x: $x \in$ GC, where GC is the set of ginger cats (*something that is a ginger cat*). The details of this representation and other examples, as well as the problem of distinction between general names and predicates (or even quantifiers, for that matter), require further discussion – we will return to it in Chapter 4.

[49] The rules of English grammar require that after applying the functor 'who' to a sentence with a general subject, the article before the subject-noun changes from indefinite to definite (from 'a

(S2) {{(**is standing in**, **boy A, that corner**)}, {(**is standing in, boy B, that corner**)}, ...}.

The function denoted by the functor ‘who’ chooses for the designate of the generated name (N) this concrete boy who appears in the factual element of the nonelementary situation (S2). Information about the result of the application of this functor can be obtained from observing two elementary situations: (S1) that a certain boy is looking at Amy, and (S3) that the same boy is standing (as the only one) in such and such corner [(S3) ⊂ (S2)] – provided that we know the result of the application of the functor ‘is looking at’ (which can be obtained from the observation of elementary situations corresponding to sentences of the type: ‘this girl is looking at that girl’; ‘that girl is looking at that girl’, ‘this boy is looking at this cat’; ‘Mum is looking at Emmy’ and so on). Situation (S1) gives the information that the expression ‘the boy who is standing in that corner’ is a name of a certain object. On the other hand, the elementary situation (S3) is the only factual component of the non-elementary situation (S2) corresponding to the sentence included in the name in question. The remaining (counterfactual) components of this situation differ from the factual ones only in the first argument of the relation ‘is standing in’, that is, they differ in who is standing in a corner. Therefore, we can conclude that the part of the name of the boy which is not a sentence (i.e. the expression ‘who’) denotes a function that assigns some object to a non-elementary situation (here: S2). The identity of the objects from (S1) and (S3), just observed, gives the information that the object which we are looking for is the one included in the factual component of S2. In this way we have performed the acquisition of the meaning of a difficult functor by observing elementary situations and we have decoded the syntax of a compound sentence. The syntax of this sentence – at a general level, separated from any particular grammar – is as follows (in order of decoding)(Table 3.3.3.1):

Table 3.3.3.1 *Example 1*

The	*boy*	*who*	*is*	*standing*	*at*	*that*	*corner*	*is*	*looking*	*at*	*Amy*
s **(a sentence denoting a visible elementary situation)**											
n (name of the concrete subject of the sentence)								*s/nn*			*n*
		n/s	*s* **(a sentence denoting the nonelementary situation)**								

boy is …’ to ‘the boy who is…’). Semantically – and therefore also on the level of general syntax – the same object involved throughout.

Let us rewrite the last sentence (to avoid the graphic partition and to include the English grammar rule for ‘the’ – ‘a’)(Table 3.3.3.2):

Table 3.3.3.2 *Example 1′*

A boy	*is standing in*	*that corner*
n	*s/nn*	*n*

Now, we can identify the meaning of this sentence with the structure:
<**is looking at,** {boy$_i$: (IS A FACT, (**is standing at**, boy$_i$, that corner))}, Amy>

Suppose that the boy is called Frank and Amy is the only girl in the context eating ice-cream. The sentence ‘Frank is looking at the girl who is eating ice-cream’ corresponds to exactly the same elementary situation as the sentence ‘The boy who is standing at that corner is looking at Amy’ – but their meanings are substantially different.

3.3.4 Meanings Versus Semantic Correlates

Some semanticists would say that having situations we do not need separate meanings of sentences (or – conversely – that since we do have propositions-meanings even in Fregean semantics, we do not need situations anymore). I do not think they are right. They would call for Bill Ockham and his razor but this is none of his business. Meanings are built up out of situations but they are not mere situations – they are structures of situations arranged according to syntax. We can very naturally distinguish three separate questions: (1) what we say (or what we talk about), (2) how we say it (what is the way of saying it), and (3) whether it is true or not. In defending the distinction between (1) and (3) – the one neglected by Frege – we do not necessarily undermine the distinction between (1) and (2) – the one Frege so firmly established.

Meaning is the way of saying things; the way we shape in words what we know. And we need meaning in semantics in all cases when our knowledge of what is said is important. In a word: we need intensions for intensional contexts. Propositional attitudes are perhaps the most eminent, but I would rather discuss the question of the so called semantic entailment. Intuitions about such entailment are not very firm. Or they are firm as to the direction of entailment, but not as to the grounds on which it holds. Quite often it is said that it is the relations between semantic correlates (situations) that grounds entailment.

Indeed, sometimes it does appear to be so. Such an approach would show easily the appropriate relationships between sentences that have arguments of a different rank of generality. For example, the sentence ‘A girl has a cat’ follows semantically from the sentence ‘Amy has Kitty’. It can be interpreted as follows: the set consisting of all (in this case: one) elementary situations corresponding to the second sentence is an element of the situation that corresponds to the first sentence. Therefore, if the second sentence is true, then the first one is also true – provided we assume existential quantification over ‘a girl’ and ‘a cat’.[50]

Things become a bit more complicated in the case of relationships between sentences about the same objects – although perhaps we could still manage without meanings provided the sentences referred to non-elementary situations. Suppose we wanted to infer the sentence ‘Someone killed someone’ from the sentence ‘Someone stabbed someone’. In this case, the situation of stabbing is in a sense a part of the situation of killing. We assume that stabbing is by definition a form of killing. Namely, stabbing is *killing with a knife*. Therefore, the semantic relationships between corresponding sentences are special cases of the relationships that occur when we compare a sentence containing a compound predicate supplied with an adverbial and a sentence without such an adverbial.

Corresponding situational relationships in all adverbial contexts can be interpreted in our approach as a relation of inclusion between the set of those elementary situations in which a certain *x* is killing a certain *y* somehow/with something and the set of those elementary situations in which *x* is killing *y*. That is, some (but not all) elementary situations of killing are (identical with) situations of killing with a knife. But how do we know this? How do we know about the function of adverbials (and – let us add – adverbs: any predicate-forming functors with predicate arguments)?

We learn about this – at the beginning of first language acquisition – only by comparing the corresponding ostensive procedures. Fristly, assume that in someone’s private language the predicate ‘kill’ as well as the adverbial ‘with a knife’ are primitive (acquired ostensively). I would hazard that for the majority of people the composition ‘killed with a knife’ is not acquired ostensively. It seems to me that the predicate ‘killed’ is acquired by people fending off mosquitoes and flies, while the adverbial ‘with a knife’ in slicing a loaf of bread or opening a tin. Therefore, the acquisition of this composition has to be preceded by an ostensive acquiring of the meaning of many sentences of the form ‘x killed y’ and ‘x did y with a knife’.

As ostensive definitions of such sentences grow in number, we realize that the set of elementary situations usually pointed out as prototypes in definitions of sentences of the form ‘x did y with a knife’ is a proper subset of the set of situations pointed out as prototypes of corresponding sentences of the form ‘x did y’. Situations from the first set belong clearly to the smaller similarity class (that is, the

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[50] Which is not always the case – compare stereotypical: ‘A Frenchman eats frogs’, where ‘a Frenchman’ is assumed to be quantified universally.

chains of indiscernibleness between different prototypes of the first set are essentially shorter than the corresponding chains between the prototypes of the second one). In other words, we notice that an Ajdukiewicz function denoted by the composition of an adverbial and a predicate, for instance denoted by the composition 'cut with a knife': *with a knife(cut)*$_{\text{Ajd}}$ assigns a nonelementary situation σ_1 to some pairs of objects. On the other hand, an Ajdukiewicz function denoted by the mere predicate *cut*$_{\text{Ajd}}$ assigns to these pairs a situation σ_2 *such that* every factual elementary situation belonging to σ_1 belongs also to σ_2, but not conversely.[51] In this way we learn how the adverbial 'with a knife' works with respect to predicates used in the given procedure (e.g. the predicate 'cut'). Namely, this adverbial assigns an Ajdukiewicz function denoted by a given predicate P (let us say: *cut with a knife*$_{\text{Ajd}}$) to another function (let us say: *cut*$_{\text{Ajd}}$). The former function takes values from the subset of the set of those situations which are values of the latter function to pairs of objects. The subset mentioned above is better defined and more homogeneous in a certain respect (in this case: in respect of the way of cutting). This definiteness and homogeneity can be easily seen – just as easily in fact as we see a certain homogeneity and definiteness of dachshunds among dogs.

The knowledge which has been acquired at this stage concerns only the concrete adverbial; in fact, it concerns only the fixed composition adverbial – predicate that has been acquired by us. In ontogenesis of speech, this stage is referred to as the verb island. At this stage, which begins after the second year of life (see Clark 2003), children comply fully with this condition: they use adverbials and qualifiers only with those predicates (resp. qualified expressions) for which they have been taught this explicitly.

At the next stage (at the next stage of logical reconstruction or at the next stage of ontogenesis of speech) we make a *hypothetical extrapolation* (of course, a hypothesis need not be made consciously; the point is that the generalization in question is provisional and removable). Then we start to apply an adverbial whose meaning (an Ajdukiewicz function denoted by it) has been defined by the procedure described above, to other predicates, whenever we are not restrained by some special reasons. We can be restrained – and forced to accept some restrictions of our extrapolation – for instance by the feeling that some compositions give evidently such an Ajdukiewicz function which assigns the empty set to any objects (some things cannot be made with a knife e.g.: watering, shouting, running , etc.).

Summarizing, thanks to the ostensive procedure we *see* that:

$$\sigma_1 < \sigma_2;$$

whereas from the way nonelementary situations are constructed we know that:

$$\sigma_1 = [\textit{with a knife}_{\text{Ajd}}\,(\textit{cut}_{\text{Ajd}})][x, y]$$
$$\sigma_2 = \textit{cut}_{\text{Ajd}}[x, y].$$

[51] Note that ostension brings out the relationships between factual situations – prototypes are facts.

From this we can get information about the adverbial ‘with a knife’, namely:

$[\mathit{with\ a\ knife}_{\mathrm{Ajd}}(\mathit{cut}_{\mathrm{Ajd}})][x, y] < \mathit{cut}_{\mathrm{Ajd}}[x, y]$;

then we can generalize this – firstly as:

$[\mathit{with\ a\ knife}_{\mathrm{Ajd}}(f_{\mathrm{Ajd}})][x, y] < f_{\mathrm{Ajd}}[x, y]$

– and then as:

$[g_{Ajd}(f_{\mathrm{Ajd}})][x, y] < f_{\mathrm{Ajd}}[x, y]$,

where f and g range over a set of various predicate functions and a set of various adverbial functions, respectively. These predicates and adverbial functions can vary, but are not arbitrary. We have to remember that it is only an inductive generalization made on the basis of ostensive patterns.

We know that:

(**is killing with a knife, *x*, *y***) < (**is killing, *x*, *y***).

only[52] *via* the knowledge that:

$[\mathit{with\ a\ knife}_{\mathrm{Ajd}}(\mathit{is\ killing}_{\mathrm{Ajd}})][x, y] < \mathit{is\ killing}_{\mathrm{Ajd}}[x, y]$.

Thus, there is a relationship between situations referred to by the sentences that could possibly license relevant entailment, but we can realize this relationship only by grasping respective meanings.

The meanings are even more indispensable when we are to account for the entailment that goes one way between sentences corresponding to a single elementary situation. We have the feeling that the sentence ‘Brutus killed Caesar’ follows from the sentence ‘Brutus stabbed Caesar’, and the converse implication does not hold. But how do we know it?

If we define entailment only in terms of inclusion of situations, then we have to accept both directions of entailment. If Brutus really stabbed Caesar (as historians claim), then the elementary situation of killing Caesar by Brutus is *the same* elementary situation as the situation of stabbing Caesar by Brutus – yet we feel a clear and strong reluctance to accept that the sentence ‘Brutus killed Caesar’ implies ‘Brutus stabbed Caesar’.

This is so because in this case intuitions do not depend on relations between denotations of sentences but on relations between *meanings* of sentences. The sentences in the above example correspond to elementary situations (so they are in a sense ‘singular’). If these sentences do not have (in private languages of individual users) an ostensive meaning, then their interpretation consists of concretization of the sentence ‘someone killed (with a knife) someone’ (‘universal’ sentence

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[52] This is the only legitimate way of knowing it, since demanding ostensive prototypes would be a criminal offence in this case.

corresponding to a nonelementary situation[53]), whose meaning can be determined by the method described above, by real examples of killing (of flies, mosquitoes, or wasps) and by examples of using a knife (for eating jam, tightening a screw and opening a can). The public meaning of this universal sentence allows certain variability in respect of relations between elementary situations that correspond to that sentence. The syntax of the predicate ‘killed with a knife’ suggests that the range of this variability is smaller than in the case of the predicate ‘killed’. The ranges of this variability – and their mutual relation (here: inclusion) – remain important also in cases where, from an universal sentence, we formulate a particular sentence by taking a concrete pair of arguments; this concretization does not concern the relation, it concerns only the arguments.

The sentence ‘Brutus killed Caesar’ corresponds to the same situation as the sentence ‘Brutus killed Caesar with a knife’. Nevertheless, the latter describes the situation more precisely. At this point, the distinction between (i) a relation between objects in a situation and (ii) an Ajdukiewicz function denoted by a predicate in an appropriate sentence is essentially applied, as discussed above. Since **(killed, Brutus, Caesar) = (killed with a knife, Brutus, Caesar)**, we have to agree that killing in the case of Brutus and Caesar is the same thing as killing with a knife, whereas Ajdukiewicz functions, $\textit{killed}_{\mathrm{Ajd}}$ and $\textit{killed with a knife}_{\mathrm{Ajd}}$, respectively, are obviously different. They have *the same values for a certain special pair of arguments* (Brutus, Caesar) and maybe for some other pairs. But in general they have different values: $\exists x,y\ ([\textit{with a knife}_{\mathrm{Ajd}}\ (\textit{is killing}_{\mathrm{Ajd}})][x, y] \neq \textit{is killing}_{\mathrm{Ajd}}[x, y])$.

The meaning of a sentence determines its denotation. In this case this determining works in the following manner: firstly, by ostension we get the knowledge (idealized and hypothetic) about the denotation of a sentence $P(x_1,\dots, x_n)$[54] for a given predicate P. Secondly, we realize that the concrete sentence (*i.e.* ‘Brutus killed Caesar’) corresponds to an elementary situation (for instance, among all situations in the denotation of the sentential function KILLED (x, y) the sentence corresponds to the one in which Brutus and Caesar occur). That is all. It is clear now that such a procedure does not guarantee a full identification of the determined elementary situation. We know that the question is about the killing of Caesar by Brutus. We could have pointed out this situation if we had seen it (by traveling back in time). But given the real circumstances, we just do not know about this situation as much as we would if we had seen it. We know only what is

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[53] We put the word ‘universal’ in metaphoric quotation-marks, because ‘universal sentence’ is usually taken to be ‘a sentence preceded by a universal quantifier’. In our terminology, a universal sentence is a sentence corresponding to a nonelementary situation (that is to a situation consisting of many elementary situations); this kind of sentences can be preceded with an existential quantifier: e.g. ‘Amy has a cat’.

[54] Literally, this is a propositional (sentential) function. As will be discussed in more detail further, it is such functions that determine denotations; a further supply of quantifiers (often depending on the context) does not influence the situation as a semantic correlate – it determines truth conditions (which we distinguish here from semantic correlates – a correlate is not a truthmaker).

included in the meaning of the predicate ‘killed’ known beforehand. If someone said that Brutus killed Caesar *with a knife*, then we would know more, because the meaning of the compound predicate ‘killed with a knife’ is more precise than the meaning of ‘killed’ (the set of situations of killing with a knife is included in the set of situations of killing).

This difference is immaterial from the point of view of someone who knows the situation by acquaintance. Such a person knows about the situation much more than the most detailed sentence can ever say. We can see that entailment has an epistemological character: the knowledge that Brutus killed Caesar does not guarantee the knowledge that Brutus stabbed Caesar, whereas if someone *sees* Brutus killing Caesar, then he obviously sees Brutus stabbing Caesar.

Therefore, the statement that the situation in which Brutus is killing Caesar with a knife is a proper part of the situation of killing Caesar by Brutus – and some people say so – has as much sense as the statement that a tabby cat possessed by Amy is a proper part or a subset of a cat *simplicite* possessed by Amy. It’s just that in one sentence this single object is called *simplicite* ‘a cat’ because of its similarity to a certain class of objects, while in the second sentence *the same* object is called ‘a tabby cat’ because of its similarity to a different (smaller) class of objects. Similarly, the same elementary situation can be described in one sentence on the basis of its similarity to one class of situations, while in another sentence it can be described on the basis of its similarity to another class. If one of these classes is included in the other, we have (semantic) entailment.

3.3.5 Situations and Truth-Conditions: Boolean Compounds and Quantification

Situations are not truth-values. But situations conceived as above are not truthmakers, either. We cannot say simply that a sentence is true when a corresponding situation is a fact, because it is quite common for non-elementary situations to be partially factual and partially not. Only elementary situations are truthmakers for their corresponding sentences.

This point is particularly relevant in the case of Boolean composition and in the case of quantification. As regards the former, we can quite easily admit conjunctive situations. A *single* situation consisting in Amy stroking Kitty and Emily kicking Garfield is not beyond our imagination (although even this kind of composition seems a bit awkward). But ontological disjunctions, and especially negations, are very troublesome. What is it – a situation (single situation) in which Amy is stroking Kitty *or* Emily is kicking Garfield? What is it – a situation in which Amy is *not* stroking Kitty? According to our approach, there is no need for such difficult ontological commitments. We would say that Boolean compounds don’t have a single correlate at all. They have rather compound truth conditions. Provided p and q are syntactically simple sentences (which does not entail that

they are correlated to an elementary situation!), $p \vee q$ is true if the correlate of p is a fact or a correlate of q is a fact. Not-p is true if the correlate of p is not a fact – and so on.

So far this is not very controversial; at least it is a quite neutral adaptation of Barwise&Perry's solution pared down to a constituent sequence alone.[55] The problem becomes more interesting when quantification is applied. According to our proposal, semantic correlates for expressions belonging to the semantic category of sentences are de facto calculated for either constant sentences (without variables and quantification altogether) or *sentential functions* – not for sentences containing bound variables. There is one and the same correlate for all sentences that can be produced from a given sentential function by different quantification. The truth condition of a sentence is determined by both the semantic correlate (a situation) and the mode of quantification. The correlate of a constant sentence – say 'Sabrina strokes Salem' – is an elementary situation, here: (**strokes**, Sabrina, Salem). As to the quantified sentences, the sentence (1) 'A girl strokes a cat' is related to the same non-elementary situation as (2) 'Every girl strokes every cat' or (3) 'Every girl strokes some cat'. This situation is calculated for the sentential function $girl_i$ *strokes* cat_i. It is a set of all elementary situations in which some particular girl (say, Anna, Betty, Cynthia, Doris, Emma, Fanny, Gloria, Holly, Imelda, Jane, Kathy, Lizzy, Mona, Nora, Oprah, Polly, Queene, Roxanna, Sylvia, Tori, Uma, Xenia, Yvonne, Zeta *etc*.) strokes some particular cat (Garfield, Salem, Nana, Kitty, *etc*.). In symbols:

$\sigma = \{s: s_{i/j} = (\textbf{strokes}, girl_i, cat_j)\}$.

Respective sentences have different truth conditions: (1) is true iff $\exists i\ \exists j\ [s_{i/j}$ is a fact]; (2) is true iff $\forall i\ \forall j\ [s_{i/j}$ is a fact]; (3) is true iff $\forall i \exists j\ [s_{i/j}$ is a fact] etc. for all combinations.

Thus, in syntactic analysis, quantifiers can be in principle neglected (although it is very important to exhibit the nominal variables to be quantified over when calculating the truth value). Quantification is ruled out of syntax altogether (except for some cases where quantifiers can be interpreted as qualifiers (*n/n*)). Quantifiers have no category and are ordered – normally (there are exceptions) – according to the order of variables being quantified. Often quantifiers are tacit; the user has to guess which quantifier is applicable – on pragmatic grounds. We will say more about it in Chapter 4.

3.3.6 Comparison with the Parsons–Davidson Theory

Perhaps I owe the reader some comparison here. The explanations formulated above recall the theory of situations proposed by Parsons (1990). His theory

[55] Originally they included a positive/negative index in the situations themselves, which is in their account a highly hierarchical, complicated structure.

improves the classical theory of Donald Davidson (1967). According to Parsons' proposal, predicates denote *types* of actions, states or relations. He states that particular sentences like 'Mary hit Fred' contain existential quantification over those actions, states or relations (Parsons 1990, p. 5). The semantic representation of a sentence like in the example could have the following form: ∃e (HIT (e) and AGENT (e, Mary) and OBJECT (e, Fred)). This allows us to represent in a nice way the adverbial modification. That is, the representation of the sentence 'Mary strongly hit Fred' has the following form: ∃e (HIT (e) and AGENT (e, Mary) and OBJECT(e, Fred) and STRONG(e)). According to this theory, semantic entailment is just a logical entailment of a component from the conjunction. However, I would rather not adhere to this theory (which is quite elegant, by the way) for similar reasons for which I do not want to rely absolutely on the semantics of possible worlds. Parsons's theory is not substantially neutral. Its elegancy comes with a price: the price is quite a strong deformation of our neutral pretheoretical intuitions described above. Consider the sentence 'Mary hit Fred'. What corresponds in Parsons's theory to this sentence? Is it a situation represented by ∃e (HIT (e) and AGENT (e, Mary) and OBJECT (e, Fred)) or is it 'e' itself? If the sentence corresponds to 'e', then Parsons's representation is not clear: we do not know what it represents and how it is licensed, so to speak. If the sentence corresponds to the situation represented as ∃e (HIT(e)… etc.), then *e* is an abstract relation, it's not the event itself. Theoretically, we can quantify over such relations, but according to our presentation it would be very non-intuitive: individual objects that can be quantified over are situations, whereas relations are abstracted from situations at a relatively advanced stage of the acquisition, when we know quite a lot about the structure of these situations and about the results of application of predicates and their modifiers. To clarify the issue let us ask the following question: what does it mean that situations denoted by sentences are *general*, that they are *types* of elementary situations? Indeed, we can agree that situations corresponding to sentences of the form P(*x, y*), i.e. 'A girl hit a boy', are general, but we cannot say the same about sentences of the form P(a, b). Parsons's example 'Mary hit Fred' is such a sentence. A sentence of the form P(x, y) denotes a nonelementary situation containing many elementary situations, which are mutually similar but not identical with respect to the relation of hitting. In this nonelementary situation we can distinguish subsets of situations in which someone is hitting someone hard or gently, with anger, or by chance, etc. In particular, we can quantify over elementary situations, so a representation similar to Parsons's would be in this case adequate: the correlate of the sentence 'A girl hit a boy' would be a nonelementary situation of the form: ∃e [HIT (e) and AGENT(e) ∈ GIRL & OBJECT (e) ∈ BOY], where 'e' is an elementary situation.[56] However, such quantification is not adequate for particular sentences. The sentence 'Mary hit Fred' corresponds to only one concrete elementary situation.

[56] The correlate of the sentence with a predicate modifier would have the following structure: ∃e [HIT (e) and AGENT(e) ∈ GIRL and OBJECT (e) ∈ BOY & STRONG (e)].

Thus, Parsons–Davidson's approach can sometimes be a useful abbreviation or interpretative scheme for the stage of language speaking at which appropriate advanced abstraction is achieved, provided that we realize and respect the limitations discussed above about the nature of 'e', as well as what and in what circumstances is general here. Here, however, we stick to the natural approach with Ajdukiewicz functions. According to this approach, predicates denote Ajdukiewicz functions rather than relations between objects or events, while modifiers denote functions of functions. As we have shown above, this approach allows us to express precisely respective semantic relationships. Though it is perhaps not a very elegant representation, it naturally arises from the theory of elementary situations and the ostensive base of a language. Additionally, our approach does not identify semantic entailment with logical entailment, as the Parsons–Davidson theory does.

3.3.7 Nominalization: Events Versus Propositions

One of the more interesting areas of situation semantics is a conceptual distinction between elementary situations as correlates of sentences, and as such largely under-determined, and real life elementary situations, perceived either at the time of speaking or experienced in the past. It is an old distinction, emphasized by Russell: *knowledge by acquaintance* and *knowledge by description*. The difference is a matter of perspective: we talk about things as we see them happen or we give a second-hand account.

This is, I believe, one of the most absorbing problems of the philosophy of language: when we see a situation and want to express it in words, our description is only a crude approximation of what we in fact see; at other times a verbal description is all we have to go on. This difference in perspective is crucial for science. A scientific description requires that we use rigorous syntactic rules and clear rules of semantic interpretation. We do so while keeping in mind nonetheless that both syntactic and semantic rules are deeply rooted in everyday communication where they do not play a significant role and are thus not subject to various selection pressures which could help to improve them. But even in everyday language this difference in perspective: direct v indirect, can make itself felt. Since time immemorial those speakers who could paint pictures in words of times gone-by, bring out the clamour of a hunt, the thundering of hooves, the smell of the prairie at sunset, have been held in high esteem by the rest of us. They are the people who have the power to make us relive situations of which we have only been rendered a verbal account.

The difference has not inconsiderable semantic consequences, which manifest themselves in nominalization: translating sentences into names of situations correlated with these sentences. A substantial literature has grown up around this problem, but the final word has yet to be written. I will give an account of it here by reference to three sources: a relevant passage can be found in the work of Terence

Parsons (1990); an extensive monograph on nominalization was written by Alessandro Zucchi (1993); the problem also features in one of the articles by Angelika Kratzer (2002).

The problem with nominalization is that, in short, the same sentence can sometimes give rise to names of different situations. For example, ‘John has arrived,’ can be nominalized to ‘John’s arrival’ or to ‘the fact that John has arrived.’ At first glance, the difference may appear to be only of a stylistic nature. But that is not the case. The sentence, ‘Mary remembers John’s arrival’ is true if and only if Mary was a witness of John’s arrival (if need be, she would be able to recollect numerous details: John’s travel clothes, the colour of his suitcase, the expression of exhaustion on his face and the happiness with which he greeted the welcoming party).

The sentence, ‘Mary remembers that John has arrived,’ on the other hand, does not have the same truth value. It may be true in a situation in which Mary learnt about John’s arrival from a reliable source: her ladyship told Mary that master John had arrived and Mary, who was not present at his arrival, goes on and makes up the bed in his room anyway, because she remembers that John has arrived. Moreover, we can legitimately say that Mary remembers (now) that John is coming next week (so she is dusting his teddy bear). What we cannot say is that Mary remembers (now) John’s arrival which will happen next week. It is also possible to juxtapose the two nominalizations in one absolutely natural sentence: ‘The fact that John had arrived made Mary happy but the arrival itself seemed to her a rather sad affair.’

The examples show clearly that ‘John’s arrival’ and ‘the fact that John has arrived’ refer in some contexts to different objects. Despite that, we are at first led to think that they are nominalizations of the same sentence, ‘John has arrived.’ In view of the above, all three authors accept that the sentence is a correlate of both the concrete situation-event (John’s arrival) and the abstract situation-proposition (the fact that John has arrived). Parsons devotes the least space of all to the problem. He explains (1990, pp. 132–135) the difference by distinguishing syntactic forms *nominal gerundives* [‘Mary’s singing *of* the song’] and *verbal gerundives* [‘Mary’s singing the song’] and the meanings in which these forms can be used: *‘eventive’ use* and *‘propositional’ use*.[57]

He observes that there is no simple correspondence between the use in a given meaning and the syntactic form, and that the choice of a given form in a given meaning is often dictated by the context. Parsons does not seek to analyze this dependence nor, least of all, give an account of the semantic difference between the two uses. He states openly that his theory (elaboration of Davidson’s conception)

[57] Parsons’s term ‘propositional use’ must be taken with care. What is at stake here is the use of a given expression as a name, except it is a name of a proposition, not of an event. The expression is not meant to be treated as a sentence. This terminology bears no relationship to Husserl’s theory of intentional acts: nominal (names) and propositional (sentences).

applies, by definition, to the eventive use of nominal gerundives, while ignoring all propositional uses as well as eventive uses of propositional gerundives.

What is left out by Parsons is taken up by Zucchi in his monograph (1993). First of all, Zucchi undertakes very thorough analyses with a view to correlating various forms of nominalization (of which he finds far more than Parsons) with the eventive and propositional meaning. His analyses are best described as linguistic analyses of the English language incorporating comparisons with Dutch and Italian. The general picture that emerges is as follows. Certain syntactic forms have a strong affinity, so to speak, with one or the other type of use. If the context of the particular use does not determine the kind of situation that may be involved, the form of nominalization will most certainly do so.

If, however, the context makes it clear that we are dealing with a situation-event (or, conversely, situation-proposition), then the syntactic form of the nominalization does not make much of a difference: any form could be used in the meaning which fits the context. It is rare for the mismatch between the syntactic form and the context to result in a sentence being completely unacceptable; if anything, we will get a minor awkwardness. Thus, the details added by Zucchi fill in the contours sketched by Parsons: whether a given form is used in the eventive or propositional meaning depends on the context. This fact is responsible for the relatively weak empirical base of the semantic theories of nominalization, but also for their fairly strong prescriptive function: they can be used to decide about the correctness of expressions (or their precise meaning) which cannot be judged by reference to everyday usage.

Zucchi proposes precisely such a kind of semantic theory – one that takes account of both types of situation. This is another reason why his monograph extends beyond Parsons's endeavours. Zucchi adapts Kratzer's semantics (1989) for his purposes. The latter's semantics is a hybrid of a semantics in Barwise and Perry style (where the correlates of sentences are individual situations belonging to one, or our, world) and the traditional possible worlds semantics as developed by Lewis (where the correlates of sentences are propositions taken to be sets of possible worlds in which a given sentence is true). This hybrid approach provides for a very elegant treatment of the problem of nominalization: it admits both individual situations belonging only to one possible world and sets of such situations which constitute propositions (compare Kratzer 1989, pp. 614–615 and Zucchi 1993, p. 65).

While Zucchi avails himself of Kratzer's semantics (1989) in making sense of his fine syntactic distinctions, Kratzer herself (2002) argues that both types of situation are indispensable to properly capture certain extra-syntactic phenomena. Situation-events, called *worldly facts* by the author, are necessary in the semantics of the verb 'to know' – they help avoid Gettier's paradox. Propositions, on the other hand, play an important role in the semantics of counterfactual conditionals.

Kratzer's semantics may then be regarded as a successful attempt to bring together two main approaches of situation theory in a way which helps to resolve, in an orderly fashion, a number of intricate problems, both syntactic and semantic. I

believe though that we should not subscribe to her views unconditionally for two reasons. First, Kratzer's semantics does indeed rely on the theory of possible worlds. It does so not by appropriating its formalism and its computational tools, but by drawing on certain intuitions characteristic of it. I would argue that it is highly undesirable to seek recourse to intuitions which can be articulated only in terms of the theory of possible worlds (owing to the metaphorical baggage of this theory).

Secondly, Kratzer's semantics does not address the problem flagged up at the beginning of this section: it does not answer the question of what type of situation a particular sentence refers to. Thanks to her semantics we can explain easily what the various sentence nominalizations (names of situations) refer to, but we are still none the wiser about what is the correlate of the sentence itself, as opposed to its one or another nominalization. For example, are there always two correlates, or is the situation-event a correlate while the situation-proposition is bound with the sentence by some other relation; or is it the other way round, in which case sentences always denote propositions while events are connected with them by another relation? Finally, could a proposition be a sentence correlate in some circumstances and an event in others?

Instead, I propose the following solution. Let us take John's arrival – a concrete situation-event – to be the correlate of the sentence, 'John has arrived.' Let us also assume that the situation-proposition, namely, that John has arrived, is not the correlate of the sentence, 'John has arrived' but of the meta-sentence, 'The sentence *John has arrived* is true.'

Everyone who rejects the nihilist (deflationist) conception of truth, whereby 'sentence *p* is true' = *p*, must concede that a given sentence and the corresponding meta-sentence are in fact two different sentences. We can thus quite legitimately assign different semantic correlates to each. The sentence, 'John has arrived,' belongs to the object language. It says something about the world. Its correlate is thus a concrete situation-event: *worldly fact*, as Kratzer would put it. The sentence, '(The sentence) *John has arrived* is true,' does not say anything about the world directly. It describes a situation which belongs to the realm of logic. It is an abstract situation. The sentence says that some concrete situation, referred to more or less directly, obtains, or is a fact.

The correlate of this sentence is thus a logical proposition. What a proposition is exactly from a metaphysical point of view does not concern us here. A traditional view, one that goes at least as far back as Frege, holds that a proposition is the *meaning* of a sentence (object sentence). The meaning of a sentence is a way of determining its denotation.

In order to determine whether the sentence, 'John has arrived,' is true or not, we do not need to know first hand the corresponding elementary situation. All we need to know is that the situation belongs to the set of all arrival situations and that it concerns John. Thus, the belief denoted by the meta-sentence, '*John has arrived* is true', that is, the fact that John has arrived, is the existence of an elementary

situation which belongs to a non-elementary arrival situation such that it involves John. The elementary situation itself however does not constitute our belief.

The proposed approach enables a natural interpretation of the examples given at the beginning of this section. Mary remembers John's arrival if in Mary's brain there is a memory trace recording a concrete event to which Mary was a witness: John's arrival. Mary remembers that John has arrived, if Mary's brain has registered that among a number of situations involving someone's arrival there is a situation involving John's arrival. The latter information may come from any source – not necessarily from Mary's having seen the concrete situation involving John's arrival but, for example, from someone else's telling Mary about it, from her having worked it out for herself, and so on. Just as naturally, Mary may remember that John is only due to arrive: her brain may have registered the information that future arrival situations include the situation involving John's arrival.

Mary may finally be happy about John's arrival being a fact (because she will no longer have to worry about him) and yet take the arrival itself to be rather sad (because, for example, it happens to be raining now, John is tired and uptight, and the welcome didn't go too well).

Our approach provides too that concrete situation-events enter into normal, physical causal relations, while situation-propositions do not. Propositions are strictly logical in nature. They are not the object but the content of cognition. Propositions enter into logical relations, for example, the relation of entailment. We can say that the *result* of John's arrival is this and that, while the fact that John has arrived has certain *consequences*. Propositions, constituting logical information, can at most affect our thinking, and only indirectly, and potentially, bear on the material world.

We can say that John's hitting the table was so strong that it knocked over all the glasses. We can't say, however, that the fact that John hit the table knocked over the glasses. The fact that John hit the table could have at most unsettled Mary, who, having learnt that John had hit the table, banged her fist on another table so hard that her blow knocked over whatever glasses there were on that table. In this way, the abstract fact that John had hit some table may be an indirect cause of all glasses falling over on a certain other table. The necessary intermediary in this chain of events, however, is the distraught Mary's mind.

The circumstances described here are reflected in language usage. It is worth noting that situation-propositions are appealed to (both through sentences for which the situations are correlates and through appropriate propositional nominalizations) especially in those contexts where reference is made to logical relations or a person's mental states. Such contexts often take any of the following forms: '*x* knows that *p*', '*x* remembers that *p*', '*x* is happy that *p*', '*x* believes that *p*', '*x* supposes that *p*', and so on, but it is quite possible to encounter sentences where the nominalization is in the subject position provided the sentence asserts some logical relation between propositions or a relation between a proposition and a person's mind. Specifically, 'that *p*' can make someone happy or sad, or provide

grounds for thinking that *q*, but cannot without the interposition of someone's mind puncture a tyre or shoo away the cat.[58]

On the basis of the proposed solution we can also lay down some guidelines on how to render the actual syntactic structure of the contexts in question. The popular syntactic analysis of the sentence type '*x* knows that *p*' is as follows (Table 3.3.7.1):

Table 3.3.7.1 *Example 2*

<table>
<tr><th>x</th><th>knows</th><th>that</th><th>p</th></tr>
<tr><td>|n|</td><td>| s/nn ||</td><td colspan="2">n |</td></tr>
<tr><td></td><td>|</td><td>n/s</td><td>| s |</td></tr>
</table>

where the functor 'that' is a nominalizator.

This type of analysis is semantically flawed, though. The flaw may not be so striking in the analysis of a sentence with the functor 'know', because only a certain proposition can be known (but even such language is highly suspect). However, let us consider a context with a functor which applies to both propositional nominalization and other kinds of names. For example, in sentences such as '*x* remembers that *p*' we can substitute another name, say '*y*', for the name 'that *p*' and get correct and meaningful sentences '*x* remembers *y*'. The point is it is one thing to remember some *y*, and quite another to remember that *p*. To remember *y* is more or less the same as to have in the memory a mental representation of a concrete thing or a concrete event *y*, as when we remember John or John's arrival.

On the other hand, to remember **that** *p* is the same as to be aware that *p* occurs. Correct syntactic analysis should be able to capture the difference, and our approach – to regard propositions as correlates of meta-sentences – provides a handy

[58] It must be borne in mind that it is not only propositions that can occur in what we may call for short 'mental contexts'. Events can likewise occur in such contexts. Finally, some concrete, physical events may also affect our mental states. Such factors make mental contexts ambiguous as to whether they refer to events or to propositions. An example is furnished by Zucchi (1993, pp. 19–20): 'Mary's resignation surprised us.' The sentence makes sense under both uses, but it is a different sense under each. On the propositional reading, it is the fact that Mary resigned that surprised us, because we did not expect her to resign. On the eventive reading, there may have been something in her resignation that was surprising – the sole fact that she resigned may not have come as a surprise to us, because, say, we expected her to do so, and yet, in one of its numerous aspects, the act of resignation was a surprise (Mary flung her bag, lost her temper, gave a surprising reason for her resignation, handed in her resignation while doing a head-stand, etc.). It may be difficult to clear up such ambiguities even in a broader context.

tool for doing so. Thus, we only need to accept (which accords with our linguistic intuition) that the functors ‘knows that’, ‘remembers that’, and so on, are syntactically simple expressions with a completely different meaning and belonging to a completely different category than the superficially similar predicates ‘knows’ or ‘remembers’.[59] The analysis looks as follows (Table 3.3.7.2):

Table 3.3.7.2 *Example 3*

<table>
<tr><th>X</th><th>knows that</th><th>p</th></tr>
<tr><td>|n|</td><td>| s/ns |</td><td>|s|</td></tr>
</table>

On such analysis, a sentence of this type does not contain any nominalization, only another sentence. The latter refers to a proposition, so it is a simplification of the meta-sentence. The expanded version should be rendered in full detail as (Table 3.3.7.3):

Table 3.3.7.3 *Example 3′*

<table>
<tr><th>X</th><th>knows that</th><th>‘p’</th><th>is</th><th>true</th></tr>
<tr><td>|n|</td><td>| s/ns |</td><td colspan="3">| s |</td></tr>
<tr><td></td><td></td><td>| n |</td><td colspan="2">| s/n |</td></tr>
</table>

As can be seen, the first level of this analysis is the same as in the simplified version. Thus, as long as no misunderstanding threatens, we can use the linguistically natural simplified version and analyze it under the normal procedure.

3.3.8 Hints for Analysis of Intensional Contexts

Intensionality comes to mind on the present occasion quite automatically: it is precisely in attitude contexts where both meta-sentences are proposed and intensionality occurs. Could the former: meta-sentences make it easier to deal with the latter: intensionality. I will not elaborate this point here but restrict myself just to giving some hints about it.

We recall that intesionality is a phenomenon where, simplifying somewhat, given a sentence about beliefs, the main clause is changed into a different, however

[59] Some functors of the type ‘… that’ do not have ‘that’-free equivalents, for example: ‘knows that’ (save for elliptical contexts). Others do, but may require a different number of arguments. For example, ‘believes that’ is a two-argument functor, while ‘believes’, a one-argument one. Similarly, ‘thinks that’ and ‘thinks’.

coextensional, sentence and the new sentence has a different truth value. Example: given the true (we assume) sentence, ‘Mary knows that Brutus killed Caesar,’ we change the subordinate clause, ‘Brutus killed Caesar,’ into a coextensional (we assume) sentence, ‘Brutus killed Terence Parsons’s favourite hero,’ and obtain false (we assume again) sentence, ‘Mary knows that Brutus killed Terence Parsons’s favourite hero.’

As explained above, the subordinate clauses are, in these contexts, simplifications of the meta-sentences, ‘*Brutus killed Caesar* is true,’ and ‘*Brutus killed Terence Parsons’s favourite hero* is true,’ respectively. These meta-sentences need not be coextensional – their denotations are the corresponding situation-propositions, not events. If these situation-propositions can be equated with the meanings of the respective sentences (‘Brutus killed Caesar’ and ‘Brutus killed Terence Parsons’s favourite hero’), the matter is settled: the latter pair of sentences is coextensional indeed but not synonymous. Their meanings are different because their denotations have been determined in different ways.

I am not sure though if we can do the equating. Propositions, in my view, are structures of elementary situations shaped according to the syntax of a given sentence, experienced in the process of language acquisition and making themselves a part of the meaning of the acquired expressions. As to what is the link between them and situation-propositions on the level of logic, I am not able to say.

4 CATEGORIAL ANALYSIS

Abstract In *Syntax* we analyzed general intuitions underlying the theory of syntax. In *Semantics* we sought to lay down a basic semantic system which could match our intuitions. We shall now proceed to give some guidelines which ought to be followed in the categorial analysis of the syntax of expressions. We will look at the analysis of some difficult sentences, where the difficulty can be attributed to various factors. We will follow the principle that syntactical theory should readily show how to capture the syntax of a sentence we are dealing with.

Keywords Categorial Analysis, Logical Form, Quantification

4.1 Problem of Logical Form (LF)

4.1.1 Logical Form and Stratification of Syntactic Structures

The logical theory of syntax describes the structure of expressions, that is, something that is not discernible (all we can discern is linear word order), something that is, figuratively speaking, under the 'surface' of the language. The distinction between 'surface' and 'depth' is not free of complications and can lead to misunderstandings. Transformational-generative grammar uses the terms 'deep structure' and 'surface structure'.

The two terms are fairly well defined there: the deep structure is a structure generated by phrasal rules from the *S*-symbol. The surface structure results from the deep structure by the application of transformational rules. The surface structure is taken to include places (some terminal elements of derivation trees) occupied by component words (or their parts, e.g. thematic roots) belonging to the expression whose structure has been generated. This alone does not make the abstract structure 'discernible' on the 'surface'. The metaphor of 'depth' and 'surface', which is core terminology of transformational-generative grammar, is based on the order of generation of particular structures rather than on cognitive availability.

Transformational-generative grammar holds that logical structures are prior to final expressions. Language starts at the level of two sets of syntactical rules and the *S*-symbol. From 'S' the rules belonging to the first set generate certain abstract structures while the rules belonging to the second set transform these structures

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into other abstract structures which in turn are assigned meaning by the semantic rules and sound by the phonological rules. If the latter are taken to be the ‘surface’ of a language, then the structures which are obtained closer to them can be referred to, seemingly naturally yet invariably deceptively, as the ‘surface’ structures, while those generated prior to them as ‘deep structures’.

Outside transformational-generative grammar the distinction between deep and surface structure is not justified and invoking it, as is done routinely[1], is an abuse. Such use greater or lesser degree follow the word order, make use of inflection, or admit the insertion of ‘missing’ elements.

Theories on what exactly the logical form of language is abound. Most can be grouped under the following statements (both from the same volume of the *Linguistics and Philosophy* journal):

> Lets agree to call the formal language of the translation ‘logical form' (Chierchia 1982, p. 303).
>
> and
>
> Logical form is simply that syntactic analysis of a sentence upon which compositional semantic interpretation is directly based (Dowty 1982, s. 26).

In keeping with the first of these quotations, logical form is a special artificial language which is free of extra-syntactic complications typical of natural languages which interfere with syntactic expression in real language forms.[2] Studies of such language have proved extremely fruitful from the logical point of view. Montague’s grammar is one such example where the logical form of the English language is identified with specially devised intensional logic. From the epistemological perspective, especially in view of the language acquisition theory, such an approach is thoroughly undesirable.[3] According to this approach, an expression of natural language must be first translated into formal language before its syntax can be determined. Meanwhile, translation rules are outside the scope of the formalization theory. It is often assumed that the translation can be supplied by some

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[1] Even Lasersohn (1995) who, among other things, sets out to put the terminology connected with logical form in order makes much of differentiating logical form (of a certain type) from a puzzling surface syntactic representation (p. 5). Equally puzzling are references in Steedman (2000), where right from the start terms such as ‘Surface Structure’, ‘Deep Structure’ and ‘Logical Form’ are bandied about without having been defined first, yet all spelt with capital letters as if they were proper names of some well defined entities.

[2] The expression ‘syntactic expression’ is a metaphor of course. The idea is not to draw comparisons with an artistic expression of subtle feelings but an expressions of genes in biology. Logical syntax determines the structure of a compound expression much as the genotype determines the phenotype, that is, in a rough manner. The actual structure of an expression, just like the phenotype of a particular specimen, depends to a large extent on external circumstances. Biologists say that the environment has an influence on the genetic expression. By analogy, we say that the ‘environment’, that is the context, has an influence on the final structure of an expression, by modifying syntactic ‘expression’.

[3] I admit, however, that Montague’s approach captures the purely logical relations far more accurately than it is possible by the approach proposed here.

means or other. This approach leaves out of consideration what is for us the nub of the problem: the mechanism of capturing the syntax of actual expressions.

This paper takes the view that logical form is best described by the second of the quotations: logical form is an analysis (a categorial analysis as we understand it) of particular expression. This analysis, being the result of certain operations, is ascribed to actual expressions and is not a part of some alternative artificial language. What this analysis is about is demonstrated in the following pages. Before that however we must deal with two complications which get in the way of determining the syntax of particular propositions. First, we must show some mechanism of separating what in an expression is determined by its logical form from what is determined by traditional grammar. Second, we must find a way of separating the expression's logical form from what is determined by extra-linguistic contexts or language habits.

4.1.2 Logical Form and Traditional Grammar

In *Introduction* and in *Syntax* we argued that consistency with language intuition – the corpus of well-formed formulas or correct grammatical structures according to traditional grammar – cannot be viewed as the key criterion in evaluating the theory of syntax. What this means is that expressions which under given theory are syntactically correct may be seen as unacceptable or ungrammatical by traditional grammar – and this charge will not be held against this theory. This approach, however, may be somewhat awkward as we attempt to analyze the syntax of an actual given expression.

Traditional grammar is a conglomerate of rules specific to one ethnic language which derive from numerous sources and perform heterogenous functions. One of these functions is to lay bare the logical structure. In Polish this function is performed e.g. by a grammatical rule which says that in order for 'Józek' to be the second argument of the functor 'zabił' in the sentence 'Franek zabił Józka' (eng.: 'Franek killed Józek'), we should remove 'e' from the root of the name 'Józek' and inflect it with 'a'. The analogical rule in English says that the name 'Frank' comes before the verb 'to kill' and the name 'Joseph' after the verb in the sentence 'Frank killed Joseph'.

There are other functions besides this one. Grammatical rules, as pointed out in previous chapters, systematize our knowledge about the extra-linguistic world and ensure economy of communication. One of those functions, for example, is performed by the rules which govern the semantic grouping of nouns into mass nouns and countable nouns.[4] Another function is visible, for example, in the rules that

[4] For instance, the rule that mass nouns require such quantifiers as 'much', or 'little' whereas countable nouns – 'many' and 'few'.

are responsible for the use of pronouns in place of proper names.[5] Grammar underpins the expressive function of language as well, next to such means of communication as gestures or intonation. This comes through where the grammatical form is correlated with the attitude of the speaker to his message. As an example, take a rule whereby optativus, that is the grammatical mood used to express wishes, requires a past tense in the subordinate clause, as in: *We'd rather you didn't bring that man to our house*.

This heterogeneity of traditional grammar's functions and dependence of grammatical rules on the historical development of the ethnic language makes it difficult to generalize about how, having an expression in that language, to determine certain parameters of its structure (such as the order of arguments, or the hierarchy of modifiers). In particular cases, usually, we can be quite successful though. Here we must simply assume that the traditional grammar of the language in question is 'transparent' to a fluent speaker of that language in terms of the logical form, that is, that there is an obvious connection between the logical and grammatical form just as it is obvious to a Polish speaker that in 'Franek zabił Józka', Józek is a designate of the second and Franek of the first argument of the main functor.

This assumption however is rather highly idealized. It is true that even though the logical-grammatical correspondence can be easily glimpsed once it has been recognized, its acquisition is time-consuming, its instances are many, and the logical schemata are often undermined by numerous exceptions. It would be both interesting and useful to nail down some explicit bridging rules between traditional grammar and logical syntax. For each ethnic language the task belongs to linguists (in particular experts in the grammar of that language) rather than to logicians or philosophers.[6] Philosophical logic could at most find the range of such correspondences but would probably have to delve deeper than is possible in this book.[7]

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[5] For instance, the rule that if we want to convey the information that John has committed suicide, we must write 'John killed himself' instead of 'John killed John'. That it is only an *economy rule* we can see by noticing that 'John killed John' is by no means ungrammatical. It is perfectly grammatical when we want to say that some John killed some other John.

[6] Van Benthem (1995, p.24) also explicitly endorses a similar view: it is within the syntactic remit of particular languages to impose restrictions on the admissability of syntactically coherent expressions.

[7] By way of a reminder, our aim is to analyze basic intuitions connected with syntax. Our examples do come from actual languages, but in quoting them we follow our idealizing assumption of grammatical transparency. Abandoning such idealization in favor of studying the relations between logical form and grammar (English, Polish, German or Dutch) would go well beyond the scope of this project. Some philosophers of language however make it their aim to analyze precisely such relations. A good example is Piotr Labenz, who in his article (2004) lays logical foundations for the grammar of tenses and aspects of the Polish language – an undertaking which requires, for example, a prior classification of events and situations.

4.1.3 Natural Technical Language: Normal Contexts

The entanglement of the syntax in semantics and pragmatics is a fact, which makes it unreasonable to apply restrictive criteria of intuitional adequacy and a sense of acceptability in evaluating the theory of syntax. This does not mean that in analyzing particular expressions we must do without the help of intuition and operate only at the formal level. The point is that natural language is stratified not only 'vertically', as the proponents of deep and surface structure would like to claim, but also 'horizontally'. In seeking to depart from everyday usage towards greater abstraction and more tangible structures we need not uncover deeper and deeper language strata (no longer 'in use') but look at other *registers* of language, not necessarily in everyday use but still used nonetheless.

We need to distinguish natural language from everyday language. Everyday language is characterized by the dominant role of interpersonal discourse and strong pragmatic relations. Each message which belongs to such discourse has a concrete speaker. A message produced in everyday language can be interpreted differently by different hearers (or by speaker and hearer); the interpretation depends on context – linguistic and extra-linguistic. Everyday language however is not capable of handling many communicative situations, including practically all scientific contexts. As the epistemological situation we want to address gets progressively complex we need to impose more and more rigorous rules on our language.

Context (and other pragmatic aspects) is relegated to a secondary role as semantics takes over. We get to a stage where our language which has been undergoing modifications consists mainly of impersonal discourse. The messages produced in this discourse do not have an identifiable speaker (at most they undergo editing in the hands of a person who is not involved in the communicative situation); there are authoritative sources (personal or impersonal: textbooks, first editions, special purpose dictionaries, etc.) which by way of regulative definitions eliminate vagueness and other semantic inaccuracies. This is typical of the language of all branches of science but also of all kinds of institutional jargons: business, legal, etc. [8]

It is clear that the degree of 'everydayness' of impersonal discourse may vary depending on how rigorous the rules are: from semi-informal announcements to something that could be called 'natural technical language': the language of science. The latter bears little resemblance to everyday language, which is its distant prototype. It is often highly modified and 'logicized'. Epistemological considerations force us to make our language suit our actual thoughts – they offer little inducement to resort only to everyday language, such as is used by an average speaker.

[8] See Tałasiewicz (2008a).

On the contrary, the care that must be given to reference should point us away from such language. After all, everyday language plays many other roles besides the strictly descriptive one. It is subject to the principle of economy of communication. Conciseness, the expressive, persuasive, performative and other functions of language as well as pragmatic aspects make the 'phenotype' of everyday language quite distinct from its 'genotype' – the optimal form for accurate descriptions. Natural technical language is thus a much better object of our endeavors as it allows us to capture its logical structure with greater precision.

We owe our interest in natural technical language primarily to its being a subject of categorial analysis: there is not much point in analyzing poetry or young people's slang in such terms. What does make sense and is often desirable is analyzing the syntax of expressions in the language of science, which are meant to be precise but which, for various reasons, do not lend themselves to translation into an artificial formal language. The group includes propositions advanced by human sciences (including philosophy) and, most importantly, propositions postulated by lawyers and legislators (many lawsuits have turned on the correct interpretation of the syntax of legal provisions). By limiting our interest to such language we will be free to justify certain preliminary analytical procedures which we discuss later – namely that the syntactical analysis of everyday language requires that this language be first 'technicalized'. We are thus taking leave of the view that the theory of syntax should of itself assign a correct structure to any compound expression of everyday language. The 'technicalization' procedure goes beyond the remit of the theory of syntax and its application may require employing complicated hermeneutic devices.

There is more to be said on this point though: natural technical language can be learnt through natural methods provided it is not 'logicized' too much (does not contain, for example, explicit variables). Language stripped of its pragmatic content, at least to a large extent, is not an idealized construct but rather a legitimate part of real language. If we try hard enough, we can use it, though perhaps not all day round. We can hear it at school and in public offices, at home too, and by listening to it we can learn it, even though it may offend our sense of style. Such language then is one of the sources from which we can obtain information about syntax

A good example of efforts to learn such language is a question once frequently asked by my daughter Olga[9], who, at the age of three, kept asking where the *here*

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[9] Much to the chagrin of the detractors, I will be using examples of my children's language. Why should my children be any different than others? On a more serious note, more psycholinguistic research is necessary to determine how certain processes happen. Arguments based on arbitrary cases are of varying usefulness and quoting them calls for a great deal of caution.

The fact remains that diaries recording children's linguistic behaviour kept by parents – not infrequently by the researchers themselves – are an important part of scientific research. See for example Clark (2003, pp. 21, 91). As well as adding to the pool of data, the practice is important from the methodological perspective: experiments may interfere with the subject of the investigation [MT: for a variety of reasons; for example, due to the sense of significance attached to the

ends. She knew well at the time that *here* could mean the bed, room, house, town, the whole area (she had no notion of a country yet), depending on the situation. She wanted to know what the word meant without the con-situation.[10] She was seeking a precise definition and was somewhat disappointed to find that its definition must be to some extent arbitrary. She didn't take long to learn how to construct such definitions and for many weeks she amused herself by identifying yet more and more 'here's' of different shapes and sizes, but always precisely defined. She was learning a technical language.

Another tool we could use besides natural technical language to minimize the influence of context on acceptable shape of expressions is the notion *of normal* meaning (or meaning in normal use). Normal meaning is commonly invoked in everyday non-technical language. The term is discussed by Georgia M. Green (Green 1996), who quotes Geoffrey Nunberg. She argues that normal meaning must be distinguished from the idealized notion of extra-contextual meaning (meaning in an empty context). There is no usage in everyday language outside the context – an empty context, in her view, is no more than a context which is unknown and uncontrolled.[11]

This does not mean that each time we come upon an expression we must check the context in which it is used in order to interpret it. Each linguistic group recognizes situations in which certain expressions are used in their typical meaning. In the absence of any information about the context, typical meaning is taken to be the intended meaning. We may well add that a child learning a language will take the normal context to be the context in which it comes to learn a particular expression (ostensive context) and the normal meaning to be the meaning in which the expression is used in this context. Further development of linguistic competence

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experiment, which calls for complete precision of expression]. Diaries, on the other hand, record spontaneous use. Discrepancies in findings occur e.g. when the problem concerns the question of whether children accept more than one word to denote one and the same object.

Experiments have shown that they don't; observation of spontaneous speech (diaries), that they do. See Clark (2003, p. 137–138). [MT: One explanation is that during the experiment the child tried hard to come up with what he or she thought was the best word for the situation in question, from their perspective, which the situation had suggested. Alternatives did not appear to be equally good and were rejected. In spontaneous speech perspectives shift constantly with no inordinate attention given to the precision of expression. Suddenly a child's language erupts into a riot of styles and expressions.] It is all the more justified then to admit examples of language use by one's own children when the aim is to indicate certain possibilities. In such cases one example is enough, even if it were to be an exception.

[10] 'Where is here?' she'd ask. 'When we are at home, you in one place, I in another place and mum in yet a different place, then *here* is at home, within the four walls of the house.' 'And if there were no walls?' she'd say. Another time when we were out in a woodland clearing she asked the same question. I said '*Here* is where there are no trees.' 'But if the trees were everywhere?'

[11] Cf. also Schütze 1996, p. 153.

and acquisition of extensive extra-linguistic knowledge, including knowledge about diverse linguistic groups and their communication conventions make the child aware of the existence of other contexts which are not typical and of word meanings which depart far away from normal word meanings.

Be that as it may, at the early stages of language acquisition, in particular at the stage of syntax acquisition, subconscious assumptions made about the normal context allow the child to concentrate on extracting syntactic information from expressions whose meaning is fixed and. We can thus disregard the pragmatic relativization in the description of syntax acquisition which we sought to outline, in hypothetical terms, in Chapter 2. The interaction of normal meaning with language acquisition explains why certain expressions which appear to be unacceptable on the grounds of their being nonsensical can be quite appropriate in some untypical context.

4.2 Principles of Analysis

4.2.1 Paraphrase Acceptability Criteria

It follows from what we have said about logical form that we should avoid paraphrasing expressions which are to be subjected to categorial analysis. Our task is to describe the structure of a proposition as it stands rather than translating it into a different language. On the other hand, the influence of context and of the rules of traditional grammar seems to suggest that it may be hard to avoid just such paraphrasing in certain cases. We shall then set out certain minimum necessary conditions which must be met for the paraphrase to be acceptable.[12] It would appear that the following three conditions must be met jointly:

(1) There must be something that will trigger the paraphrase. A paraphrase is acceptable e.g. if a direct analysis of an expression which is intuitively comprehensible and fully acceptable leads to a syntactic inconsistency, or when, coupled with any analysis, a semantic interpretation of an expression which is intuitively comprehensible and fully acceptable yields a meaningless or absurd result.

(2) The paraphrase of a natural language expression must be itself a natural language expression.

[12] It would be useful indeed to develop a complete list of necessary and sufficient conditions. I believe though that any such analysis would have to rely on establishing the relations between traditional grammar and logical form, to which I refer in the previous chapter. In other words, we'd have to study the findings of analysis of particular ethnic languages.

(3) The paraphrase must be completely synonymous with the expression being paraphrased.

Condition (1) is an injunction against paraphrasing expressions only to make our task easier. Analytical difficulties are often useful in gaining a better insight into the structure of an expression and discovering the less obvious interpretative possibilities or brining to the surface hidden (and often taken for granted on the subconscious level) ontological or factual assumptions. A hasty paraphrase will push us in the direction of a loose translation into some sub-language with an oversimplified syntax, which can speed up a crude semantic interpretation but which will obscure the real structure of the proposition rather than expose it. Condition (2) is a reminder to analyze natural language, not some other language. It makes a stronger claim as well, namely that the acquisition principle be respected: it must be possible to recover syntactical structures from actual utterances. Condition (3) is self-explanatory – we must analyze a construction whose semantic interpretation produces the meaning we are after.

An example of a paraphrase which satisfies all three conditions is a paraphrase of the expression 'John is easy to please'. Direct analysis inclines us to attribute to John the quality of easiness, but not the kind we mean when we say 'She is an easy girl'. However, easiness, outside this rather frivolous context, is a quality which is attributed to activities, not people. In order to avoid such undesirable semantic consequences we can paraphrase our expression as 'It is easy to please John'. Such a paraphrase is an ordinary expression in natural language and means exactly the same as the expression being paraphrased. [13]

An example of a paraphrase which most certainly does not satisfy jointly the three conditions is a transformation of 'Ala has a big cat' into 'For any *x* (*x* is a cat, *x* is big and Ala has *x*). The latter is not a sentence of natural language even if the quantifier-symbols have been left out.

4.2.2 Categorical and Facultative Rules

Our claims made in earlier chapters concerning mechanisms for determining the structure of expressions allow us now to formulate the rules of categorial analysis which bring together the possibilities and the limitations of categorial-semantic analysis.

The basic categories rule. The rule says that all arguments of the main functor in an expression which belongs to a basic semantic category themselves belong to

[13] The problem of how exactly the paraphrase is triggered and what ultimately the preferred analysis of the sentence is will be discussed in the next chapter, in connection with the analysis of infinitive verbs. At this point, it is worth noting that a similar paraphrase is recommended by Montague in PTQ (p. 248).

a basic semantic category (not necessarily the same category: the original expression could be a sentence while its main functor's arguments could be names).

The rule should be followed if we obey the dictum that our analysis should not rely on arbitrary assumptions and the adjusting of a syntactical system to preconceived constructions but rather show the real possibilities of capturing the syntax. The analysis can be set up so that the original expression is divided into constituents and each constituent save one is pre-assigned its category. Such assignments can be made only for the expressions belonging to the basic categories. Only such categories can be recognized extra-syntactically, on the semantic level.[14] An analysis violating the basic categories rule would be reduced to the use of only loose assumptions, in arbitrary configurations, without firm underpinnings.

The rule is also shored up by a strong intuition that in order to construct an expression of independent meaning we must use 'materials' which themselves have independent meanings. Independent meanings of compound expressions do not come from nowhere – they are functions (made up of functors) of independent constituent meanings. The rule recognizes the course we took at the outset, whereby each functor contained in a sentence must be an operator of some order (or part of an operator) and there are no functors in a sentence[15] which play the role of arguments only.

The basic categories rule allows us to take a critical view of those kinds of categorial grammar which fail to satisfy it. They include the calculus proposed by Geach (1970). In discussing the role of functors we analyzed sentences such as: 'Socrates is flying' and 'Every man is flying', and their negations.[16] According to Geach, an expression of category *n* in the former sentence is replaced with an expression of category *s/(s/n)* in the latter. Such resolution affects our rule, because the latter sentence is analyzed into functors alone.[17]

The superfunctor rule. In line with this rule all arguments of the superfunctor (the functor-generating functor) belong to the same category as the functor being generated by the superfunctor or to a basic category.

The superfunctor rule is complementary to the basic categories rule. At each stage of the analysis we get precisely one main functor (the operator). If at some point the functor turns out to be a compound expression, we must proceed with our analysis – by identifying the constituents of the functor and assigning them some categories. How do we know which categories? As noted, we are not able to identify functors as such on the basis of semantics alone. The category assignable to the main functor in propositions which belong to basic categories can be deter-

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[14] See the previous chapters. The starting point for the analysis is a semantic identification of expressions with an independent meaning, that is, expressions belonging to the basic categories. The idea that we can determine the functor category in advance is a fallacy.

[15] It could of course be the case that compound functors are comprised only of functors.

[16] Geach 1970, p. 4. See section 2.2.3 of the present book.

[17] Tips for the analysis of quantifier contexts are given later in the book.

mined by elimination, that is, by separating all other constituents which belong to such categories. So much is stated in the basic categories rule. Compound functors do not lend themselves to this procedure. It may happen that none of the compound functor's constituents belongs to a basic category (e.g. the functor (*s/nn*) 'likes a lot' can be construed as ((*s/nn*)/(*s/nn*) *s/nn*)). Which constituents then can be known in advance? Besides sentences and names, we can have prior knowledge of those functors which belong to the same category as the functor which constitutes the original expression at this stage of our analysis.

This is possible thanks to the criterion based on Ajdukiewicz's definition of categories: expressions which are interchangeable *salva* syntactic consistency in a given context belong to the same category. All that must be done is to substitute the arguments of the superfunctor of our compound functor for that whole compound functor. The argument which ensures consistency of the whole expression belongs to the same category as the functor under analysis. For example, in the sentence 'The lilac smells strongly', the main functor is a compound expression: 'smells strongly' (category *s/n*). One of the constituents of this expression, namely 'smells', can be substituted for the whole expression in the original sentence, and the sentence will remain a sentence: 'The lilac smells'. This constituent then belongs to the same category as the whole compound functor 'smells strongly', that is *s/n*. The remaining constituent 'strongly' is thus the superfunctor of the category (*s/n*)/(*s/n*).[18]

Our other example is: 'A girl, so beautiful that *p*, sings so heavenly that *q*'. In the first order of analysis the problem is quite straightforward: (some) girl (somehow) sings: (*s/n n*). In the second order, we have the name 'A girl so beautiful that *p*', which shares the structure with 'A such-and-such girl', that is (*n/n n*). The functor 'so beautiful that *p*' (*n/n*) consists of: the argument 'beautiful', which belongs to the same category as the whole functor (*n/n*), and the superfunctor 'so that *p*' (*n/n*)/(*n/n*), which is analogous to the functor 'very'. The latter superfunctor takes in turn argument '*p*', which is a sentence (*s*), and a higher order superfunctor 'so that', belonging to category ((*n/n*)/(*n/n*))/*s*. The main functor of the whole sentence: 'sings so heavenly that *q*', is analyzed in a similar way (Table 4.2.2.1).

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[18] The assumption here is that functors which differ only in the number of arguments, for example, *s/nn* and *s/n* belong to the same category. Alternatively, we can think of them as functors belonging to different categories but modify accordingly the relevant superfunctor rule. At any rate, the functors are identifiable by reference to one another (all we need to do is abstract from the number of constituents they bind), and as such they satisfy the condition stated in the justification of the rule. Thus, if one of the functors is a compound expression, the second could be an argument within this expression. Take the following situation: 'Łukasiewicz died in Dublin' ([died in] *s/nn* [Ł.] *n* [D.] *n*), where the functor 'died in' consists of the superfunctor 'in' ((*s/nn)/(s/n*)) and the argument 'died' (*s/n*). For details of generalization over the number of arguments see *e.g.* Steedman (2000, p. 42).

Table 4.2.2.1

A girl so beautiful that p sings so heavenly that q***

| n || s/n |

| n || n/n || s/n || (s/n)/(s/n) |

|……. | n/n |… (n/n)/(n/n) | |….. | (s/n)/(s/n) |…………(A) |

|…… | … (B) || s | |……| … (C) || s |

A=((s/n)/(s/n))/((s/n)/(s/n))

B=((n/n)/(n/n))/s

C=[((s/n)/(s/n))/((s/n)/(s/n))]/s

* **

John looses his breath *birds fall into silence, enchanted*

| n | | s/nn | n | |..n.. | | s/n ||……….. |

|n/n || n | | s/nn | n | | n/n

| |

| s/n || D |

D=(s/nn)/(s/n)

The rules discussed above are categorical rules – an analysis which does not take them into account is inappropriate (is a spurious analysis – the rules summarize the rational possibilities of making real analyses). In the literature we also come across facultative rules, which are designed to simplify the analysis and limit the number of admissible analyses of a given expression (limited syntactic alternation). Jadacki (2003, p. 120) lists, among other rules, the following facultative rule:

‘(R-4) All arguments of a given functor belong to one and the same semantic category.’

Rules such as this are an intuitive generalization of regularities which are encountered in typical contexts, but apart from the fact that an analysis which satisfies such rules is particularly clear and natural, the rules are not justified on theoretical grounds. Their appeal is in their practical application – as noted, they cut the number of correct analyses. They can and should be followed but only if there are no reasons to the contrary. Often, though, good reasons against doing so exist. For example, it appears (see cases discussed in the previous chapter) that attitude contexts require an analysis where the main functor is a sentence-generating functor involving one nominal argument (denoting the subject of the attitude) and one sentential one, conveying the content of the attitude. Such analysis violates Jadacki’s (R-4) rule, but I don’t think we should give it up only for this reason.

4.2.3 Syntactic Ambiguity: Amphiboly and Alternation

The categorical rules described above – imposed, as we noted, by the requirements of the general theory of syntax – are not sufficient for a clear and unambiguous analysis of all expressions. They allow numerous possibilities of assigning diverse syntactical analyses to many expressions. Facultative rules can help reduce this number, but even they do not guarantee an unambiguous syntactical analysis. Besides, as noted earlier, they cannot be used in all cases. There is nothing unusual in the ambiguous results we get from syntactical analysis – many expressions are syntactically ambiguous (amphibolic): the same expression read differently means different things. It is only right to expect and require that a syntactic analysis expose the ambiguity. The trouble is that the rules as they have been formulated allow plenty of interpretations when it comes to expressions viewed as syntactically unambiguous.

This interpretational freedom can be curtailed somewhat if we agree to bring into our categorial analysis some elements which will make it fit the traditional grammar of a particular language, where the grammar prevents certain structures while favouring others. In other words, the idea is to admit rules which would eliminate structures being least intuitive from the perspective of traditional grammar. Such elimination usually proceeds intuitively and automatically during a categorial analysis, but particular rules may just as well be formulated explicitly. A good example of rules which eliminate undesirable constructions in Polish (yet which are acceptable within the larger framework of categorial grammar, *e.g.* in Ajdukiewicz's calculus) is given by Witold Marciszeski (1987). One of these rules says that where a two-argument sentence-generating functor is concerned which takes one sentence and one name, then the name must be the first argument and the sentence the second, never the other way round.

It is clear however that while recourse to such rules may limit the problem to a certain extent, it will not remove it completely. We continue to face prima facie two types of ambiguities in syntactical analysis: amphibolies and alternations. Let's have a closer look then.

Amphiboly. Amphiboly is a syntactic polysemy: the different syntactic structures that can be assigned to one expression result in the different meanings of this expression. Each structure should be paired with a clearly distinguishable meaning, or at least an intuitively graspable nuance of meaning. The possibility of indicating distinct meanings is the most prominent feature of amphiboly. Examples abound – the problem is a textbook classic. To add yet one more, let us write out the first few levels of sentential analysis (Tables 4.2.3.1 and 4.2.3.2):

Table 4.2.3.1 *Example 1*

Hela	*believed that*	*Atanazy went mad*	*because*	*he was trying to read Proust*
n	*s/ns*	*s*		
		s	*s/ss*	*s*

Table 4.2.3.2 *Example 1′*

Hela	*believed that*	*Atanazy went mad*	*because*	*he was trying to read Proust*
s			*s/ss*	*s*
n	*s/ns*	*s*		

The first analysis brings to the fore the meaning according to which Hela's speculation centers on Atanazy's madness, the reason for her speculation being his attempt to read Proust (the attempt then was a symptom of his madness). According to the second analysis, no particular reason is stated for Hela's believing Atanazy to be mad, rather her speculation has to do with Atanazy going mad after an attempt to read Proust (in Hela's view, his attempt was the cause of the madness).

Alternation. In a number of cases it is not possible to assign intuitively distinct meanings to the different variants of the analysis. If there is no reason to question these variants, we have an alternation. No matter which syntactic analysis we choose, each one will do.

In Ajdukiewicz's calculus we find an example of an alternation where we can replace a two-argument predicate with a superfunctor which forms a one-argument predicate with one name on condition we first modify that name's syntactic position appropriately. This possibility can be expressed by the alternation rule governing the extraction of predicate arguments: *s/nn* → *(s/n)/n.* The rule can be extended to more arguments and other functors. Each functor can without fear of consequence be treated as a one-argument functor (Tables 4.2.3.3 and 4.2.3.4):

Table 4.2.3.3 *Example 2*

Alice	*has*	*a cat*
n	*s/nn*	*n*

Table 4.2.3.4 *Example 2′*

Alice	*has*	*a cat*
n	*s/n*	
	(*s*/*n*)/*n*	*n*

The question is how to interpret this 'dual ambiguity': amphiboly *vs* alternation, or how to avoid it. Studies into the logical structure of natural language have traditionally sought to find a way to avoid this duality, that is, eliminate the alternation by some means. This tradition goes back to Ajdukiewicz's claim: 'Every meaningful and unambiguous expression, … can be decomposed without any residue into its components *in exactly one way*, so that one of those components relates to others and connects them into a meaningful whole' (1978, p. 270; italics MT). Characteristically, these attempts involve laying down sets of rules for the analysis and looking for some intuitive justification for them. This concerns the facultative rules, illustrated earlier on. Some studies into the matter have come a long way (see e.g. Jadacki 2003) – nowhere however, in the literature known to me, have they been an unqualified success.

The sets of rules which are offered always fail to account for some alternations; their justification is none too strong either. Anyone who has ever tried to eliminate ambiguity in analyzing an expression will be familiar with the attendant difficulties. Both the original proposals for the syntactic calculi made by Ajdukiewicz (positional calculus (Ajdukiewicz 1967), inflectional calculus (Ajdukiewicz 1978) and other systems of categorial grammar Geach (1970) or Lambek, after Buszkowski (1989)) admit a large number of competing syntactic descriptions for the same expressions.[19]

It would appear that the difficulties inherent in this tradition are not accidental and that the claim to eliminate alternations advanced by Ajdukiewicz himself leads to a dead end. Theoretically, this claim extends to amphiboly – it is purported to concern expressions which are unambiguous. In practice, it cannot be applied in a rational way. The introduction of additional rules eliminates certain constructions regardless of whether they are responsible for alternations or amphibolies. In order to eliminate an alternation only, without eliminating the amphiboly, we would have to know in advance which expressions are ambiguous and which are not, something that the analysis itself is supposed to show. For the analysis of the syntax of expressions to be a rational undertaking, we would need to rid ourselves of the urge to eliminate the ambiguities of syntactic analysis – by means of numerous ad hoc rules which would ban multiple variants – and learn instead to interpret the ambiguities of categorial analysis.

There are also independent reasons for tolerating, if not embracing, alternations in syntactic analysis. For example, the rule governing the extraction of arguments mentioned earlier, where it sanctions most alternations which escape the attribution of different meanings, is actually quite useful. It allows us to construct simpler calculi (or ones which can be more conveniently formalized). A good example is the Lambek calculus, which employs only one-argument functors. It also achieves a closer fit with the requirements of traditional grammar.

[19] Many more examples of alternations which cannot be interpreted by reference to amphibolies can be found in Marciszewski (1987).

We shall look by way of an example at the sentence (after Geach (1970)): ‘All the girls admired, but most boys detested, one of the saxophonists’. An analysis of this expression which would ignore the alternation mentioned above would pose a number of problems – one needs only realize that the sentence is not the elliptical way of saying: ‘All the girls admired one of the saxophonists, but most boys detested one of the saxophonists’. The first sentence makes it clear that the girls admired and boys detested the same saxophonist. No such thing can be inferred from the second sentence. Meanwhile, thanks to our alternation we can easily make the following analysis (for the sake of simplicity I shall ignore for the moment the question of quantification) (Table 4.2.3.5):

Table 4.2.3.5 *Example 3*

The girls	*admired*	*but*	*the boys*	*detested*	*one*	*of*	*the saxophonists*
		s/n					*n*
	s/n	*(s/n)/(s/n)(s/n)*		*s/n*			
n	*(s/n)/n*		*n*	*(s/n)/n*			

The crucial step in this analysis is assigning category *(s/n)/n* to the words ‘admired’ and ‘detested’ whereas in most ‘normal’ contexts the words would be two-argument predicates.

Here is another example of ‘legitimizing’ alternations (Geach 1970). If we insist on following the intuition that the negation of a sentence should be equivalent to the negation of the main functor in this sentence while retaining in both cases the same category *s/s* (though it is hardly the only intuition; it is easy to imagine for the negation to take on different categories in different contexts: sentence negation, name negation, functor negation), then Ajdukiewicz’s categorial reduction rules (‘simplification of fractions’) will not do.

If we negate the whole sentence, say, ‘The lilac smells’, the analysis is as follows: ‘it is not the case that’ (*s/s*) [‘smells’ (*s/n*) ‘the lilac’ (*n*)] [*s*]; if, on the other hand, we negate the main functor, we get: [‘doesn’t’ (?) ‘smell’ (*s/n*)] [*s/n*] ‘the lilac’ (*n*). According to the Ajdukiewicz calculus, in this context we would have to assign category *(s/n)/(s/n)* to the negation. Were we to keep the standard *s/s*, the main functor would cease to be a syntactically coherent unit. According to Geach (1970, p. 5):

> In this case, we can satisfy the demands of intuition if we supplement the Ajdukiewicz multiplying-out rule with a recursive rule:
> If $\alpha\,\beta \rightarrow \gamma$, then $\alpha{:}\beta\delta \rightarrow {:}\gamma\delta$.

A special example of this rule in our notation would be the rule:

If *s/s s* → *s* then *s/s s/n* → *s/n*.[20]

In accordance with this rule, the compound functor 'does not smell' (*s/s s/n*) would not be syntactically incoherent. Instead it would be assigned category *s/n*, or a category which would make a sentence with the name 'lilac'. Geach believes that in both cases the so called proper string of indices remains unchanged (only the reduction rules change), which ensures that the meanings of both variants are identical. [21] It is then a typical rule which sanctions syntactic alternation and one which does not affect the meaning of the expression under analysis. The rule can in fact be generalized so that it does not refer to the negation only. The generalized rule, in keeping with the purpose for which it was introduced, brushes away concerns about whether the functor of a higher order modifies the whole expression of a lower order or only its main functor.

It must be borne in mind that Geach's rule is a one way rule only: each sentential operator behaves like an adverb (of category *(s/n)/(s/n)*), just as it forms a predicate when combined with one (only under different reduction rules). Adverbs however cannot function as sentence operators (a category *(s/n)/(s/n)* expression does not form a sentence when combined with a sentence). Geach provides a good example by distinguishing grammatical adverbs such as 'presumably' or 'probably', to which he assigns category *s/s*, from grammatical adverbs such as 'passionately' or 'sincerely', which are also logical adverbs (*(s/n)/(s/n)* – accurate to the number of places). He observes that adverbs of both types cannot be combined conjunctively: the expression: 'passionately and presumably' is nonsense (Geach 1970, p. 9). [22]

[20] The consequence of this rule is the so called (Composition), first referred to in Section 2.2.3, where it was distinguished from rules governing the *category-lifting* procedure.

[21] See Geach (1970, p. 5). Incidentally, Geach is wrong in claiming that by preserving the proper sequence of indices we can avoid amphiboly. The Łukasiewicz notation, which is used to determine the cardinal sequence, is sufficient to indicate in an unambiguous way the syntactic positions of particular expressions in cases where the only way of reducing fractions is through the Ajdukiewicz procedure. Once we admit Geach's functional composition, that notation becomes syntactically ambiguous. This can be easily seen when we use the improved notation of syntactic positions developed by Ajdukiewicz in 1960 (published in English in 1978). Geach's categorizations [*s/s (s/n n)*] and [(*s/s s/n) n*)] do indeed produce the same proper sequence of indices. But the difference shows in the notation from 1960: (1,0) (1,1,0) (1,1,1) in the first and (1,0,0) (1,0,1) (1,1) in the second case.

[22] The importance of letting adverbs be adverbs (even though their function can often be performed by sentence operators) has not been lost on Cresswell (1973, p.140). He provides an example of an adverb which must be regarded as a predicate modifier but not a sentence operator. Consider the two sentences: *Arabella follows John* and *John precedes Arabella*. According to Cresswell, the two are synonymous. If so, then adding the same modifier (adverb) to each of them should not affect the synonymity.

But it does. The sentences 'Willingly Arabella follows John' and *Willingly* 'John precedes Arabella' are no longer synonymous since the first says that it is Arabella that follows John willingly while the second, that it is John that precedes Arabella in that manner. One of the two persons need not find this relation agreeable. In Cresswell's view, the example shows that the modifier 'willingly' must refer to the main functors 'follows/precedes', rather than to the whole

The strongest argument in favor of admitting alternations in the syntactic calculus is the fact that the distinction between amphibolies and alternations is vague – the alternation can be seen as a way of capturing nuances in meaning, so subtle however that in some contexts they are either irrelevant or indiscernible (in other contexts, though, perhaps important). The vagueness can be appreciated by considering the alternation rule *s/nn* → (*s/n)/n*, whereby arguments can be joined to the functor one by one rather than all at once (see above). By analogy, we should allow the rule *s/ss* → (*s/s)/s*. Meanwhile, Geach (1970, p. 7) sees a semantic difference in the categorial difference *s/ss* and *(s/s)/s*: the first category includes the subordinating connectives, the second – the coordinating ones.

It could be argued that whether we take the different analyses of the same expression under one type of calculus to be alternations or seek out a different meaning for each of them depends vastly on broadly understood pragmatics, especially on how precise we intend to be. At least for a decade now (i.e. since van Deemter and Peters 1996) it has been widely recognized that the meaning of the expressions of natural language is (and most probably must be) underdetermined to some extent. We adjust the required precision to given circumstances – and 'purely' syntactic ambiguity can help us to be more specific when needed. In a nutshell: if we do not want to be enormously precise, we count certain categorizations as mere variants; however, we do assign to them real difference, if we need to do so. Here are several examples.

'Ajdukiewicz was a son-in-law of Twardowski' has two plausible categorizations in classical categorial grammar (Tables 4.2.3.6 and 4.2.3.7):

Table 4.2.3.6 *Example 4*

Ajdukiewicz	*was*	*a son-in-law*	*of*	*Twardowski*
n		*s/nn*		*n*

sentences. It is worth noting, by the way, that even though Cresswell reaches a correct conclusion ('willingly' is indeed a logical adverb, not a sentence operator), his argument as such is flawed.

The sentences 'Arabella follows John' and 'John precedes Arabella' are not synonymous to begin with. They differ in a nuance of meaning which is hard to spot in everyday use but which shows up on closer analysis. Since the sentences can be preceded with the adverb of intention 'willingly', then 'follows' and 'precedes' cannot be understood to be purely spatial relations between two bodies moving in space (on this interpretation 'follows' does indeed denote the converse of 'precedes') but take on the intentional aspect. It is one thing to follow someone intentionally (whether willingly or not), and another to move in the same direction a certain distance behind (when I go to get a cup of tea from the kitchen I probably move in the same direction as someone who travels from Warsaw to Stockholm, but it would be absurd to say that I follow him). Once we take this difference into account, the synonimity argument goes out the window.

Table 4.2.3.7 *Example 4′*

Ajdukiewicz	*was*	*a son-in-law*	*of*	*Twardowski*
n	*s/nn*	*n*		
		n	*n/n*	

In every-day speech there is no corresponding distinction in meaning. The two possibilities of syntactic parsing are just alternations. But not in the language of ontology, where extreme precision is required. In this language the first categorization can be connected with a meaning according to which there is a difficult and complicated relation between two individuals; the second categorization expresses a meaning whereby there is a (quite simple) relation ∈ between an individual and a set of individuals. These two meanings differ substantially as to their ontological commitments. The latter is a much more cautious way of saying things (and therefore may be preferable against the former, which is, on the other hand, syntactically simpler). The set involved here is small – Twardowski had three sons–in–law as far as I know – and need not be individuated by a complicated property of being someone's son-in-law. On the contrary, the set itself can be defined ostensively; and the notion of being someone's son-in-law would be sort of explained in this way (much like in the case of natural kind terms).

Another example: 'Łukasiewicz died in Dublin'. This example is a special case of a general problem with two approaches to adverbial phrases. Again, we have two plausible categorizations (Tables 4.2.3.8 and 4.2.3.9):

Table 4.2.3.8 *Example 5*

Łukasiewicz	*died*	*in*	*Dublin*
n	*s/nn*		*n*
	s/n	(A)	

(A) = (*s*/*nn*)/(*s*/*n*)

Table 4.2.3.9 *Example 5′*

Łukasiewicz	*died*	*in*	*Dublin*
n	*s/n*		
	s/n	(*s*/*n*)/(*s*/*n*)	
		(B)	*n*

(B) = ((*s*/*n*)/(*s*/*n*))/*n*

Is there any difference in meaning? Well, it depends on how much we want to say by saying this. Without any context there probably would be no semantic difference – mere alternations. But according to, say, the theory of questions, this syntactic difference would reveal a difference according to the question to which our sentence is an answer.[28] According to the first categorization, 'Łukasiewicz died in Dublin' is one of the possible answers to the question 'How Poland and Ireland are related to each other' ('dying in' is one of the relations between something Polish and something Irish). According to the second categorization, the question could be 'What were the circumstances of Jan Łukasiewicz's death'?

The list of examples could be endless. Virtually every compound expression can have different categorizations such that in some circumstances we would not expect any difference in meaning corresponding to these categorizations while in other circumstances these differences would serve us as a tool to convey certain subtleties of meaning. In fact, if we only use two forms in one discourse, there will be a difference – at least in implicature – imposed on them. That is due to the pragmatic principle of contrast, analyzed by Eve V. Clark: 'Speakers assume that any difference in form signals a difference in meaning' (2003, p. 144).[23] For every alternation we can have – in certain circumstances – a separate meaning. If we don't , we will make one up, as Clark says.

4.3 Details of Categorial Analysis

4.3.1 Notation and Technical Assumptions

In simple cases, as with the relatively simple examples quoted in our discussion so far to illustrate a point we were making, the semantic analysis is quite straightforward and fairly easy to square with our intuition. This is why we have set our analysis at levels FP(a) and FP(b) of syntactic description, that is we have shown the syntactic positions (graphically and in selected cases by means of the zero-one-two… notation) and semantic categories (by means of Ajdukiewiczian indices). In more complex cases it is advisable to use a notation which can capture semantic constructions explicitly (level FP(c)). Such notation need not be, and in fact due to space considerations should not be, part of natural language. I present such notation below, including examples of analyses and discussion of the main assumptions on which it is based. Some of these assumptions have profound philosophical implications and should serve to stimulate further discussion rather than be taken as fixed precepts. Their discussion is in part a continuation of our efforts

[23] Cf. also Clark (2002).

to correctly describe level FP(c), commenced in Chapter 2, and in part a tentative attempt to tie up logical form with the apparatus of traditional grammar.[24]

4.3.1.1 Names

First, proper names are names. Second, we assume that common nouns in simple supposition, like ‘a dog’, are names, too. Semantically they may be represented by the formula [x: $x \in$ DOG], read: ‘x such that x is a dog’, provided they are subject to quantification. Perhaps this is not the most fortuitous choice of notation but there is in it something that reflects the real procedure of acquisition of such expressions. The expression’s designate is the object that is pointed to in an ostensive procedure in connection with the utterance of the expression. Such a procedure might be represented just by ‘$x \in$ P’, where $\in$ is a primitive symbol of pointing or somehow activated association, and P is a (hypothetical and idealized – see Section 4.3.2.3) denotation of the uttered expression. However, independently from the genesis of the names’ meaning, we will treat the formula [x: $x \in$ P] as a representation of a syntactically simple expression of the category of names.

This statement requires some more extensive comment, as the classification of common nouns (and the treatment of determiners in the languages where they do appear) is a subject of serious and complicated debate in the philosophy of language. In the original Ajdukiewicz’s account such expressions are classified as names. In many newer accounts, however – like in Montague grammar or in the works of Max Cresswell – they are called predicates or even… quantifiers.[25]

At the level of syntax it is quite a fundamental difference, though. It is not just the difference between categories, but between categories basic and derived. This issue touches then the very nature of reference, hidden somewhere in the jungle of incommensurable notions, crossed oppositions and countless commentaries Nevertheless, we must cut a rough path through it, or fly over it. I opt for the latter here, leaving the machete work for some other occasion. So I would rather say which oppositions are not particularly relevant here, at this level of generality, than discuss them in detail.

What is important is the intentional act, ‘the act performed by someone who hears and understands…, but sees no reason to pronounce any judgement…’ as Husserl has said. What makes an expression a name is nothing but our intention – in a Husserlian sense: directedness – towards something without making *any* judgement about it; a mere handling of something in mind without stating anything. Once we have it, it is not particularly important whether, say, we use a

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[24] Some technical details, too, have only been roughly sketched out. The proposed notation is sufficient to capture the nuances which are discussed later; it is not a fully developed formal calculus.

[25] Cf. *e.g.* Cresswell (2002, p. 550): ‘… these theories claim that what appears to be an existential quantifier like **a cat** is really just a predicate’.

name referentially or attributively (in the sense used in discussions triggered by Donellan 1997, first published in 1966). This does not mean that this distinction is not important on its own. Certainly sometimes we refer to some objects directly, at other times however – only in virtue of their having certain properties or satisfying certain predicates. This difference can lead to certain interpretational difficulties.

If we deal with expressions that do not refer to their designates directly but only through connotation, that is by stating certain properties of those designates, we can infer that it is the properties of those designates that are epistemologically prior to the designates. The real names then, in accord with our intuition, are only proper names (or name variables). Some philosophers such as Montague went as far as equating designates of proper names with bunches of properties, which leads to the elimination of the name category altogether.

I claim these considerations irrelevant for syntax.[26] Even in the case of attributively used descriptions this does not make them predicates, which denote functions from objects to situations. Names can be constructed out of different sorts of expressions, quite naturally from whole sentences even (as in ‘the girl that is talking to the Queen right now), but if only they serve the syntactic purpose of presenting the object of a nominal intentional act, they are names independently from the history of their construction and the ontological struggle for priority between objects and their properties.

It is not particularly relevant, either, whether we are directed to one particular object, or any object satisfying a certain condition, or maybe some group of objects, or whatever comes first. These issues – whether a name is a singular term, or a general name (and what kind of general name), or maybe a generic expression – may be crucial when we try to establish the truth-value of a given sentence. But not when we are about to decide whether we are dealing with a name or not. All these are names, syntactically.

There is only an appearance of difference when a general name is indeed used to state the property of an object which has been given a different name, for example: ‘Fido is a dog’. In such cases we can take the general name to be in formal supposition (signifying the whole species) while its proper semantic representation is simply [DOG] (set of dogs); the copula ‘is’ is interpreted as an inclusion.[27]

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[26] I am not particularly impressed by them on the grounds of semantics, either. According to my conception of ostensive acquisition of names, epistemically primitive are neither objects, nor properties, but rather *kinds of properties*, which establish grounds for detecting similarity and individuating objects. The properties themselves, whether they are primary properties or conglomerates thereof (universals), are described ostensively by means of particular objects they are properties of. In line with this intuition, the tendency to compare objects, for example, in terms of colour, is epistemically prior to objects themselves, but the particular colour is secondary to the objects. What is the property of being yellow can be conceived of by inspecting yellow objects. We can learn about the property of being human only by considering human beings. We can in fact identify a human being perfectly well, with only a vague idea of what properties are associated with a human being (connotation of ‘human being’).

[27] That is, unless we assert a property which is predicated of only one dog: ‘Burek is the dog that saved my life,’ or ‘Burek is my fifth dachshund.’ In such cases the copula ‘is’ must be interpreted

Alternatively, we can take the whole expression ‘is a dog’ to be the predicate. However, we then have to regard it as a compound expression consisting of the copula ‘is’ and the name ‘a dog’, its standard interpretation being [x: $x \in$ DOG]. Any gains made by simplification are thus illusory.

Third, generic expressions are also names. For instance, the sentence ‘Four boys were carrying a table’ in a non-generic interpretation contains a non-generic general name ‘boy’ and the explicit numerical quantifier ‘four’. On this interpretation the sentence means that each boy was carrying the table, but it is not decided whether all of them were carrying it together, or perhaps each of them was carrying it by himself for some time, taking turns. On the other hand, on the generic interpretation the sentence contains as a subject a generic name ‘FOUR BOYS’, designating a four-member group of boys, and an implicit existential quantifier over such groups.[28] On this interpretation the whole four-member group carried one table, not each of them in turns.

Articles in languages where they are used are not quantifiers. They are qualifiers, that is functors of the (*n/n*) type (see below) or dependent parts of names whose role is to define the kind of name.[29] Thus, the indefinite article ‘a’ in English implies a non-generic general term (generic interpretation is possible with bare nominals). A name which is preceded by an indefinite article can be quantified then, but it is not decided whether it takes on the universal or existential quantifier. Claims in the literature that the indefinite article is an existential quantifier are misplaced. The definite article ‘the’, used with nouns in the singular, implies a definite description, not subject to quantification. Such names are treated syntactically on a par with proper names. ‘The’, used with plural nouns, admits a generic interpretation. So much by way of illustration. Let the linguists thrash out further details of these assignments.

It is worth noting at this juncture that the above considerations are applicable to the typical contexts in which the expressions we analyze occur. In keeping with our conception, there is no exception-free correlation of the semantic categories

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not as a symbol of inclusion but as identity with an object. Names which appear in the complement are then in simple supposition.

[28] Given a suitably limited universe of discourse, the generic name ‘four boys’ becomes a singular name (in this universe of discourse there are no other foursomes of boys).

[29] Even authors who claim that common nouns are predicates rather than names admit that such expressions can be turned into real names by adding a determiner – see, for example, Cresswell (1973, p. 135). In categorial grammar determiners are actually functors. If nouns, too, which are arguments of functors, were to be functors (predicates), then the names which they make would consist of functors only. This would contradict the general syntactic rules adopted earlier. Meanwhile, by treating nouns as names we are free to interpret articles as qualifiers (functors belonging to category *n/n*).

Further, our interpretation allows us to avoid the not inconsiderable problem that Cresswell, for example, has with abstract and mass nouns, which, depending on the reference intended, would be names at one time and predicates at another. For Cresswell, the expression ‘water’ could be the name of all watery substance and a predicate asserted of a random sample of water (1973, p. 139). For us, it could also be the name of that sample.

with the traditional parts of speech. Expressions which belong to the same part of speech can have different semantic categories in different contexts, while semantic categories can consist of expressions belonging to different parts of speech. Any correlations must only be viewed in statistical terms, and, statistically speaking, nouns in the nominative case are names. Recall that in line with our considerations the categorization of expressions is not imposed a priori but is developed in the process of analysis of particular expressions, based on their meaning. The same word can be categorized differently in different contexts. [30]

4.3.1.2 Predicates

Predicates, which together with the arguments they take form sentences, are interpreted semantically in accordance with the rules of the standard predicate calculus: **killed** (John, Peter).[31] A special type of predicate is the copula 'is' which occurs in a simple subject-verb sentence of the 'A is B' type. It is understood to be systematically ambiguous. Typically a sentence which incorporates it says that the subject designate is a member of a certain set or is identical with a certain object. If the former, then the subject complement must be in formal supposition; if the latter, then in simple supposition. The subject and its complement may both occur in formal supposition. In that case, 'is' signifies inclusion.

Predicates usually take the form of inflected verbs (or combinations of 'is' with names, in accordance with what was said earlier). Infinitives on the other hand perform a range of functions. They can be names (names of activities) as in: *Navigare necesse est*. For reasons of economy they can also be simplified combinations

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[30] Cresswell may have unwittingly given an example of just such a context (1973, p. 148): 'The mayor presides.' He points out the ambiguity of this apparently simple sentence – by adding to it the modal operator 'it is necessary that'. On one interpretation of the sentence, the word 'mayor' refers to a person who is a mayor here and now (as is clearly the case with 'I can't talk now because the mayor is here,'). In such cases adding the necessity operator invariably makes the sentence false (unless the person we are talking about is, for example, the son of a dictator who always presides, irrespective of the position currently held).

On anther interpretation however, the sentence may be taken to say that whoever is a mayor presides (by virtue of his office), and if we assume that presiding is one of the rights/duties of the person holding the office of a mayor, then the sentence preceded by the necessity operator remains true. In order to explain this ambiguity, Cresswell pursues a fairly complicated and highly counter-intuitive conception according to which definite descriptions have a scope in the same sense as quantifier phrases. In the meantime, the explanation is quite simple. All we need to do is to acknowledge that, on the first interpretation, the noun 'mayor' is – as is normally the case with nouns – a name, while on the second interpretation the noun is part of the predicate. The whole sentence is then an ellipsis, which can be eliminated by saying, 'Whoever is a mayor presides.' The latter is a compound implication (see further down).

[31] Any formalization of this notation would likely require that the (two-argument) predicate be symbolized as: $\lambda x.\ \lambda y.\ \mathbf{kill}\ (x, y)$. The same goes with the symbolization of other functors. I believe though that the introduction of the lambda calculus at this level of generality would not provide any philosophically interesting insights.

of the predicate and its first argument (which is the subject of the sentence). This happens in particular when the subject is implied or undefined.[32]

By way of an example, we shall look at the last point in greater detail. Contrary to appearances, the sentence: ‘John is easy to please,’ contains an undefined subject. Sentences such as this are products of complex processes. The source form of the sentence is: ‘Peter easily pleases John’. However, John may be generally easy to please, regardless of who it is that tries to please him. Economy of expression dictates that in such cases the subject ‘Peter’, which only confuses matters, be concealed. The subject is then absorbed by the predicate, which takes the form of the infinitive, and cuts the number of arguments by one: ‘please (x, y)’ → ‘to please (y)’. The remainder, or the adverb, is categorically uncoordinated with the ‘new’ predicate. The problem is solved by employing the often mentioned principle that the modification of the main functor is equivalent to the modification of the whole sentence and by transforming the adverb ‘easily’ into a sentential operator. Such a category, (*s/s*), is assigned to expressions with the so called expletive subjects: ‘It is easy [to please John]’. The sentence must be analyzed as follows (Table 4.3.1.2.1):

Table 4.3.1.2.1 *Example 6*

It	*is*	*easy*	*to please*	*John*
	s/s		*s*	
			s/n	*n*

This is an expression ready for use. However, in certain contexts we may need some further modifications. ‘Subjects tend to be perceived as topics even if some other constituent, such as a sentence-initial adverbial, precedes them’ – say Karttunen and Zwicky (1985, p. 11). The reverse is obviously true, too: topics tend to be placed in the subject position. So, if it is John that is the topic of our conversation, we may be tempted to have ‘John’ as the subject of the sentence. So we replace the expletive with ‘John’, until we finally get: ‘John is easy to please’.

Now, proper semantic analysis requires stepping back all the way to original form. As a result we’ll get: $\forall$x [x easily pleases John].

4.3.1.3 Qualifiers

Adjectives usually perform the function of qualifiers (name-generating functors taking nominal arguments), such as ‘black’ in the sentence: ‘A black dog is barking’, or of names (general names), as in the sentence: ‘The dog is black’. The former

[32] Elimination of such a subject from the explicit structure of the sentence is probably motivated by the economy of communication requirements.

is an attributive use, the latter – predicative use (the terminology is rather confusing for our purposes because it has been attuned to the treatment of general names as predicates, a practice we seek to reject here). Just how semantically different the two uses are can be seen from an example proposed by Cresswell involving a flea called Fifi. The sentence: ‘Fifi is a large flea,’ where ‘large’ is used attributively, is true, because Fifi is indeed large as fleas go. The sentence: ‘Fifi is large,’ where the adjective ‘large’ used predicatively, is false, because even the fattest flea will not be a large object. However, the word ‘large’, used predicatively, that is, as a name, signifies large objects, just as the name ‘green’ signifies green objects. In attributive use the word only modifies the extension of relevant noun (vaguely, as it is a vague word).

In analyzing particular utterances it is not so straightforward to decide which use the speaker meant. Predicative use may only be an elliptical way of using the adjective attributively. When we say: ‘Our Fifi is large’, we are unlikely to mean that Fifi has reached the size of King-Kong. Grice’s maxim of quality suggests that this is an elliptical way of saying that Fifi is a large flea.

Adjectives used predicatively are simply names. The sentence: ‘This jumper is green,’ can be interpreted as:

is(This – jumper, GREEN).

Adjectives used attributively, as qualifiers (functors of the *n/n* type), can be interpreted semantically as functions from names to names. Full formalization would require the use of lambda-calculus, but we would rather keep somewhat looser notation: **green** (‘x: $x \in$ P’) = ‘x: $x \in$ GREEN–P’.

This notation captures the fact that the qualifier ‘green’ denotes a function which assigns green P’s to P’s. The output of this function may vary according to what green P’s really are (it may be defined for different P’s completely independently). In particular, it need not be defined as an intersection of a set of all P’s and a set of all green objects. The green P’s need not be green at all (they may be ‘inexperienced’). Moreover, Q-attributed P’s need not be P’s at all, just as a false friend is not a friend.

Qualifiers formed from sentences merit special attention. Compare the sentences: ‘John is very modest,’ and ‘John is so modest that he didn’t mention his success’ (Tables 4.3.1.3 and 4.3.1.4).

Table 4.3.1.3 *Example 7*

John	*is*	*very*	*modest*
n	*s/nn*	*n*	
		n/n	*n*

Table 4.3.1.4 *Example 7′*

John	*is*	*so*	*modest*	*that*	*he*	*didn't*	*mention*	*his*	*succes*
| n |	|s/nn||					n*			|
		n*=*modest*	*so*	*that*	*he*	*didn't*	*mention*	*his*	*succes*
		| n ||				n/n			|
		|	(n/n)/s ||				s		|

In the first sentence, the word 'very' is a qualifier, which transforms the name 'modest' into the name 'very modest'. The same syntactic function is performed in the second sentence by the expression 'so that he didn't say a word about his victory'. Thus, it too is a qualifier. It is a special qualifier though, consisting of the sentence 'he didn't say a word about his victory'and the superfunctor 'so that', which on this reading belongs to category *(n/n)/s*. The semantic structure of this superfunctor is quite complicated, as is the semantic structure of any functor-generating superfunctor taking sentence arguments. Qualifiers are normally responsible for modifying the connotation of a particular name with respect to some additional property.

In the case of ordinary adjectives, which state this property explicitly, the notation may add this property to the general name, as demonstrated above. This time however, matters are somewhat more complicated. The given property is known only implicitly. The kind of property we mean is a property which, if possessed by a given object, bears somehow on the truth of a particular sentence (not necessarily connected with this object): is the reason or a necessary or sufficient condition for the particular state of affairs (e.g. John's modesty is responsible for that John doesn't like to mention his successes). It is precisely the occurrence of a relation between this property and this state of affairs that is the sole source of information about this property. The property cannot be characterized differently. The semantic representation of this qualifier must contain the representation of the whole sentence. We agree then, as regards our notation, that such qualifiers will be symbolized as colon expressions: ':p'[33]; then by adding the name 'x: $x \in P$' to it, we will get the name 'x: $x \in P$: p'. For example, 'x: $x \in$ MODEST: ~ **mentions** (John, his success[34])'.

4.3.1.4 Adverbs and Verb Complements

We shall refer to predicate-generating (super)functors taking predicate arguments as logical adverbs. This category typically includes adverbs as they are traditionally understood: 'fast', 'well', etc. Their semantic properties – the fact that they denote functions which assign predicates to predicates – will be rendered, for

[33] The 'p' symbol stands for a particular sentence here.

[34] This is a case of nominal interpretation of infinitives, as names of actions.

the sake of simplicity, as concatenation: the combination of 'runs' and 'fast' will be rendered simply as 'runs fast'.

Logical adverbs however include not only grammatical adverbs but also verb complements. It may turn out that predicates may consist of an unlimited, unknown in advance and undeclared number of arguments[35] (the literature refers to this problem as *variable polyadicity problem*, see Zucchi 1993, p. 124). Let us compare the following sentences:

'John buttered the bread'

'John buttered the bread using a knife'

'John buttered the bread using a knife in the bathroom'

'John buttered the bread using a knife in the bathroom at midnight'

Sentences such as these are grammatically simple sentences. They have only one verb (the main functor is a predicate, not a sentence conjunction). They defy simple analysis though in that it is not easy to analyze their syntax. This is because such sentences can be expanded ad infinitum. Their expansion involves adding new names to describe the object which conveys information in a communicative situation: 'knife', 'bathroom', 'midnight', etc.

There are two main strategies for reasoning about how the names are combined with the predicate. Under the first strategy, all these names, including the subject 'John' and the verb object 'bread', are equi-coordinated arguments of a very complex predicate. In the last of these sentences, the predicate is the expression **'buttered_using_in_at'** This predicate must be analyzed on several levels. On each level the appropriate preposition is a superfunctor which forms an (n + 1) argument predicate from an n-argument predicate. Under the second strategy, each prepositional phrase is taken to be a logical adverb (predicate modifier), while the prepositions themselves are adverb-generating functors taking name arguments (the exact index depends on how many arguments a given predicate takes; in the case of two-place predicates, as in 'John buttered the bread', the prepositional index has the form of: $((s/nn)/(s/nn))/n$).

These strategies, or rather analyses resulting from their application, display alternation qualities in quite a few cases. An example of such alternation was given in Section 4.2.3. In it we argued that under certain circumstances it might be advisable to use the first strategy (for example, when we wish to emphasize the relation between Łukasiewicz and Dublin, it is instructive to isolate the complex predicate 'died in'). Outside these circumstances, the first strategy has certain

[35] Although there is the minimal number of arguments: one for intransitive verbs and two for transitive ones. Langacker would call the latter 'a trajector' and 'a landmark' (cf. Langacker 1991, p. 10). Expressions with predicates with less than the minimal number of arguments (like Langacker's example: 'The best way to learn is to read') must be treated as elliptical (in other words: they trigger paraphrasing).

flaws which do not appertain to the second strategy (which makes it preferable), while the latter has advantages which the former lacks.

First of all, some more complicated cases of application of the first strategy conflict with the principle of learnability. Even the first order sentence structures are too complex to comprehend intuitively. The human mind is not specialized in processing multi-argument relations. The second strategy is free of such drawbacks: the first order analysis is quite simple (a *somehow* modified predicate with two arguments – the *sense* of this modification may come through only after we have intuitively grasped the main structure and the rough meaning of the first order sentence).[36]

Secondly, the application of the second strategy makes it possible to give a uniform treatment to prepositional phrases and common adverbs (typified by lacking a name in their make-up).

Thirdly, and last, the second strategy treats uniformly prepositional phrases and logical adverbs in the instrumental case in languages where this case is rendered by means of an inflected noun ending, as in Polish. The adverb-generating functor taking a name argument, which corresponds to a preposition, can be identified with the ending of the instrumental case which is grammatically integrated with a name (noun in the nominative case). Since under the second strategy the prepositional phrase is also relatively well integrated (the name and the preposition make a part of the expression being analyzed), no serious difficulty occurs.

Under the first strategy however, the preposition combines not with the adjacent name but with the predicate; the combination of a preposition and a predicate argument is not a part of the expression being analyzed. It is hard to conceive how an instrumental noun ending could 'skip' from an argument to the predicate and come to modify the predicate rather than the noun with which it combines.[37]

Finally, we accept that unless the context forces us to choose otherwise we will use the second strategy, the adverbial interpretation strategy. This approach is grounded in the traditional grammar of many languages where there exists an explicit procedure for introducing the specially important predicate modifiers (temporal, special, modal).[38] We can refer to them using the adverbs of time (yesterday), place (in Warsaw), and manner (using a knife).

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[36] This claim is the more valid the more complicated the sentence we have on our hands is. It is just about possible, I believe, to capture intuitively a relation such as **died in**. With **buttered_with_using_in_at** – not much of a chance.

[37] The claim obviously loses some of its force in languages where nouns are not inflected, as in English.

[38] Here, modality must not be taken metaphysically, as a way of defining existence which could be either possible, contingent or necessary, but in the ordinary sense as a manner in which something is done or takes place. The predicate 'kill' in the sentence 'Jan killed Piotr' is a modal predicate not in the sense of Jan killing Piotr out of necessity or, conversely, by accident but in the sense of one killing the other with a knife, a fork or by drowning him in a spoonful of water.

4.3.1.5 Quantifiers

Here I will complete the outline of my theory of quantification, parts of which were scattered throughout the text. I realize that it is at odds with mainstream accounts, yet I claim it a very simple one, well suited to categorial grammar, and, simply, the closest to the truth: to real procedures of evaluating sentences. Thus, I will not argue in detail with the standard account (Partee and Rooth 1983, Carpenter 1997, Steedman 2000, Cresswell 2002 – and many, many more), because I start from completely different premises. Alternatively, one can regard the whole present book as such an argument. Instead, I will show how quantification works in my conception.

As we have already established, quantifiers are not functors at all, they do not contribute to the calculation of the semantic correlates of sentences. They are used to formulate the truth-conditions of sentences together with their correlates. Sometimes they are given explicitly, sometimes not. The same goes for their scope and for the variables that are supposed to be bound by them. Sometimes this information is somehow embedded in the sentence, sometimes not. In the latter case only pragmatic reasoning and ruling out some of the most absurd possibilities can give us a hint as to how to interpret a sentence. A misleading hint, in some cases. There are misunderstandings in communication, aren't there?

Sentences containing general names in *suppositione simplici* are subject to quantification. The denotation of a given name is a range of bound variable. The default quantifier is usually the existential quantifier (Yesterday a dog bit me = ∃x [**yesterday(bit**(x: x∈DOG, me))]. On some occasions, however, the default quantifier can be general ('A student must learn sometimes').[39]

Default quantifiers do not usually appear *explicite* in a sentence. Here we abandon the idea of quantifiers being associated with some explicit constituents, in particular with articles or general names. Articles define the kinds of names; if anything, names define the range of variables bound by the quantifier (and their relative order in the sentence, as explained later, suggests the relative order of quantifiers). Neither the names themselves nor the articles are quantifiers. Even expressions such as 'everything' are not quantifiers. 'Everything' is in fact a combination of the explicit quantifier 'every' and a nominal variable which it binds.

Being aware of this fact helps clear up some misunderstandings. For instance, a compound sentence *p* may contain a constituent which, in its explicit form, does resemble a certain other sentence *q*. Closer analysis shows it not to be the case, though. In keeping with our approach and unlike under the alternative conceptions,

[39] Universal quantifiers are then treated as stereotypes, with exceptions allowed. They are read: 'for most' rather than 'for every'. Speakers may not be sure which quantifier is the implicit quantifier in a given communicative situation; the result being miscommunication and misunderstanding.

no contradiction results, as sentence *q* may have implicit quantifiers which the suspected constituent of sentence *p* does not. Here is an example:

(1) ‘John owns a donkey ‘= $\exists x$ **own** *(*‘John’*, x: x∈ DONKEY))*;

(2) ‘If John owns a donkey, he beats it’ = $\forall x$ *[***own** *(*‘John’*, x: x∈ DONKEY)* → **beat** *(*‘John’*, x)].*

Explicitly, sentence (1) looks as if it was a constituent of sentence (2). This appears not to be the case once the quantificational structure is exposed (because the existential implicit quantifier disappears).

Quantifiers can also range over adverbs (adverbial quantification): the bound variable is then the nominal variable which is part of the adverb (in our notation we shall symbolize adverbs using variable indices assigned to predicate letters, for example, $P_t(x)$). In particular, we can distinguish temporal quantifiers (‘always’, ‘sometimes/once’), spatial quantifiers (‘everywhere’, ‘somewhere’), and modal quantifiers (‘anyway’, ‘somehow’). It is assumed that, in the absence of the relevant information in the expression being analyzed, the default quantification, as before, is the weak quantification. The sentence ‘Jan killed Piotr’ is taken to say that Jan killed Piotr somehow, some time and somewhere.[40]

In general, we cannot rule out that some circumstances pertaining to a situation which the speaker may choose to express in a sentence will turn out to be important and that they will have to be taken into account *explicite*. Therefore, grammatical adverbs of manner may refer to a variety of things, such as: whether Jan killed Piotr with intent, without intent, in passion, in cold blood, *etc.* The assumption is that a sentence which does not contain the relevant adverbs must be comprehensible without the circumstances being specified beforehand.

It is not always easy to distinguish between object and adverb quantification. The literature refers to the so called quantificational variability effect – QVE. Cases involve equivalence of sentences with quantificational objects with sentences containing quantificational adverbs, for example: ‘A blue-eyed bear is always intelligent’ = ‘All blue-eyed bears are intelligent’ (von Fintel 1997). The standard equivalents are: ‘always’ = ‘all’, ‘usually’ = ‘most’, ‘often’ = ‘many’, ‘sometimes’ = ‘some’, ‘seldom’ = ‘few’ and ‘never’ = ‘no(ne)’. The quantifiers in each pair, however, must not be held to be identical. Nor can we accept a theory which provides for only one type of quantification (object quantification).

In some cases, the difference between sentences with quantificational objects and quantificational adverbs, though hard to grasp, is important and we must find a way of bringing it out. Von Fintel (1997, p. 31) quotes an example which, according to him, represents a serious difficulty. The truth conditions of ‘Emma usually smiles at a visitor’ and ‘Emma smiles at most visitors’ are very similar. They are not the same though. Were Emma to smile only at some frequent visitors but not at the majority of infrequent ones, then the original sentence would be true while the paraphrase, false. Adverb quantification is therefore necessary. (Adverbial

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[40] By analogy, there are cases which admit universal quantifiers (in any combination).

quantification is also necessary as a proxy for quantification over situations, more about which further on).

The order of the implicit quantifiers is not important as long as they are all of the same type. Deciding the order of explicit quantifiers, however, does represent a problem. Usually these are other than implicit quantifiers (exceptions include emphatic use, such as ‘Kill him somehow!’, or contexts where Grice’s maxims have been violated, for example, ‘How did you kill him?’, ‘I killed him one way or another’ = ‘it is none of your business’). Only such quantifiers comply with the economy of communication maxim.

Thus, we abandon any notions whereby the scope of a quantifier in a sentence and the choice of implicit quantifiers can be determined solely by means of syntactical devices. This is done by a pragmatic elimination of certain readings and, to some extent, by guessing at the speakers’ intentions. An excellent example of such readings being dependent on extra-linguistic considerations, and in particular on the ontological commitments of language users, can be found in Bart Geurts (2002). It is right to accept then, after Massimo Poesio (1996, p. 183), that the most appropriate semantic representation of scopally ambiguous sentences is by showing their syntactic structure and fleshing it out with the semantics of individual lexical items.

As a first attempt, we can for instance adopt the (weak) rule according to which the order of quantifiers = the order of occurrence of variables bound by those quantifiers.

This rule may be broken if the conventional order of quantifiers does not reflect the situation which the speaker seeks to describe. That is why sentences with quantifiers in their usual places may appear to be ambiguous. The grammar of a language may have reserved special structures for capturing particularly important nuances of meaning, specifically a special word order. The case in point is the operation of scrambling and pseudoscrambling in German and Dutch (moving the object in front of the subject (scrambling) or in front of the adverbial (psuedoscrambling)).

The quantifier order and scope ambiguity tends to be exaggerated. The classic example of such ambiguity is the sentence ‘Everybody loves somebody’. It is claimed that the sentence can be read: for every x there is a y such that x loves y, or there is a y such that every x loves y. It is not clear, however, what makes the second reading justified. In a normal, non-persuasive use of language the sentence cannot be interpreted to mean that there is someone whom everybody loves.

This idea would likely be expressed in a different way, most probably involving the mention of this special person’s name, for example, ‘Everybody loves Cindy‘ (or: ‘Everybody loves just one particular girl and her name is Cindy’). The expression ‘Everybody loves somebody’ is pragmatically unambiguous. Another example. Cresswell claims that the sentence ‘Everyone does not love Arabella’ can be interpreted in two ways: ‘Nobody loves Arabella’ or ‘Not everyone loves

Arabella'. And that is the crux of the matter. In real life speakers would use one of these two sentences, because, intuitively, the original sentence is objectionable on grammatical grounds. It is not actually syntactically ill-formed, but its ambiguity is so great that the sentence is disqualified from the pragmatic point of view. If such a sentence occurs in a discourse (as is when an uncooperative speaker seeks to confuse his listeners), it should be paraphrased separately for each of its meanings prior to its analysis.[41]

Analyses of quantifier phrases and a pragmatic discussion of their results are deferred to the next chapter. Before we get there, let us pause over the following question: could adverbial quantifiers possibly range over the whole situations? Such a view is widespread among theoreticians (see for example von Fintel 1997). Here, however, we shall argue against it due to the theoretical difficulties this approach entails, and also because it is counter-intuitive.

The main theoretical difficulty lies in the fact that in order to quantify over situations we need to have a well developed ontology of situations. Our ontology must be capable of identifying and counting the situations. This is fairly easy to achieve formally, but it is not quite clear in what relation theoretical situations stand to real situations. It is difficult to specify, for example, what is the minimal situation which is correlated with the sentence 'John runs'. Many theoreticians avoid answering such questions.[42]

According to our conception it is crucial for syntax analysis that elementary situations be intuitively accessible (some of them may be just visible). Any further situation calculus, including the rules of individuation of complex situations, must be subordinated to this requirement (a moment's reflection shows that the rules are open-ended in natural language). For the purposes of our calculus we shall use some kind of situational index over which quantification can range: typically the index is a time coordinate of the situation, sometimes – a space coordinate (sometimes either one, in which case we use the following expressions interchangeably: when something is the case/where something is the case, for example: 'when there is wood being chopped, then there are wood chippings flying; where there is wood

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[41] Incidentally, paraphrasing is one of the main tools in teaching classical predicate calculus. Students learn how to symbolize variables and operators by learning how the transposition of variables or quantifiers in a schema affects the interpretation of this schema into natural language. The interpretation must be unambiguous of course. It could be argued that people would not be able to learn the use of special symbols for variables and operators, or how to construct artificial languages, were it not for the fact that natural language (natural technical language) ensures unambiguous interpretation of quantifier phrases. Such phrases may sound awkward and drawn-out, but they can be expressed. Clearly, once acquired, artificial languages may be used to express ideas so complex as to be outside the capabilities of natural language. In such cases though, natural language ambiguity is not an issue – there is no natural language at all in the area of interest.

[42] 'I will chicken out at this point and leave this issue for some other time' (von Fintel 1997, p. 5).

being chopped, there are wood chippings are flying'.[43] Such coordinates, in particular the time coordinate, are characterized by a high level of theoretical organization. They can be represented by a geometric line (time) or two/three lines (space). Adverbial quantification is thus a proxy for quantification over situations.

Another problem concerns the fact that without further restrictions quantification over minimal situations does not always (or hardly ever) serve the purpose for which it was introduced – for interpreting sentences such as: 'when Jan visits his parents, he usually takes a train'. From this we should be able to infer that most times when Jan comes to visit his parents are the times when he takes a train. However, the minimal situation connected with the sentence 'Jan visits his parents' does not include a means of transport. Authors who advocate quantification over situations (for example von Fintel 1997, p. 6; Parsons 1990, p. 18) must introduce additional restrictions.

For example, a restriction may say that in such cases the minimal situations must be widened in order to include the relevant information. This has undesirable consequences; namely, John's visiting of his parents becomes part of the situation of traveling by train, even though our intuition tells us things are the other way round (von Fintel spots the problem but does no more than recommend giving it further consideration). Meanwhile, in our treatment of the matter, the answer is quite straightforward: the time coordinate is present in both situations, and it is this coordinate that is being compared (a relevant example is analyzed in the next chapter).

A certain syntactic difficulty arises as well: quantification over situations defies attempts at symbolization. It is clear that language (the languages I am familiar with at any rate) avoids quantification over the whole denotations of sentence, or situations. Indeed, stating a sentence subject to such quantification would smack of a syntactically suspect tautology: $\forall p\ p$. The point is that quantifiers are used to indicate the objects we want to say something about in a sentence.

A sentence does not say anything about the situation it denotes. It states the situation. It is only another sentence, where the name of the situation occurs, that says something about it. And it is only then that we can, theoretically, quantify over situations. In real life only those sentences sound natural that say something about one particular situation. As it happens, the potential quantifier is often built into a sentence which is part of the complex name of that situation (in such cases it is an ordinary adverbial quantifier). For example:

(1) 'Alice's jumping is dangerous' – the subject is an elementary situation;

(2) 'The fact that they always steal cars gets me down' – the subject is a single situation which is made up of a sentence (Table 4.3.1.5.1):

[43] Even philosophers such as Parsons who advocate quantification over situations concede that the time parameter plays an important role (Parsons 1990, p. 25).

Table 4.3.1.5.1 *Example 8*

[always]	*[(thieves)*	*steal*	*cars]*
	|	*s*	|
	| *n* ||	*s/nn* ||	*n* |

$\forall t\ \exists x\ [\mathbf{steal}_t\ (\text{THIEVES}, x{:}\ x\in\ \text{CAR})]$,

where the first quantifier is an ordinary temporal quantifier (ranging over points in time/intervals, not over situations) while the second one is an implicit quantifier over the general name ‘cars’. The name ‘thieves’ (an implicit one in Polish, but represented by a pronoun in English and French) is a generic name, not subject to quantification.

In semantics, the subjects of sentences (1) and (2) contain situational names, but these are constants rather than variables bound by some kind of situational quantifier. We can then risk a claim that such constructions are allowed in a language only if the relevant situation (designate of that individual constant) can be identified in a satisfactory manner.

Finally, one other issue which may cause some misunderstanding needs to be mentioned. Whenever we feel the urge to say that in a situation where one sentence is true another is true as well (and this kind of urge often prompts us to quantify over situations, see von Fintel 1997, p. 3), we are not in fact quantifying over situations. All we do is express an implication. A good example (one that is often found problematic by supporters of quantification over situations) is *‘When Mary knows French, she usually knows it well’.[44] This sentence does not admit any quantifiers. Full stop. Analyses of such examples are given in the next chapter.

4.3.2 Examples

4.3.2.1 The Order of Quantifiers: Scrambling and Pseudoscrambling: Adverbial and Object Quantifiers

Some languages, such as German or Dutch, admit the so called scrambling and pseudoscrambling. These are syntactic operations whereby either the subject and the object are swapped around (scrambling) or else the object (or the subject) and the adverb are interchanged (pseudoscrambling). The semantic result of these operations, however, is not a change of places of the arguments of the predicate. The

[44] The trouble is that if we do want to interpret such contexts by means of quantification over situations, the sentence quoted should be grammatically correct, which it isn’t.

latter remain where they are. Rather, the order of quantifiers changes (two object quantifiers as a result of scrambling and one object and one adverbial quantifier as a result of pseudoscrambling). Let us look at these operations using the examples given by Schenner (2005).[45]

(1a) […*dat*] *de politie altijd krakers oppakt* (normal),
the police always vagrants arrests

(1b) [… *dat*] *de politie krakers altijd oppakt* (pseudoscrambling)
the police vagrants always arrests

On our interpretation the analysis goes as follows. 'Police' is given a generic reading and can be treated as a singular term. Because the sentences contain the temporal quantifier 'always', we must add an implicit temporal argument (variable) which is bound by this quantifier to the predicate 'arrest', which has two explicit object arguments. 'Vagrants' is a general name in simple supposition, which can be quantified.

In sentence (1a) 'always' comes before the quantified object 'vagrants'. Thus, in the syntactic structure of this sentence the temporal quantifier will come before the implicit object quantifier which binds the object quantifier. (Table 4.3.2.1.1)

Table 4.3.2.1.1 *Example 8'*

[always]	*[$Q_{vagrants}$]*	*[the police*	*arrests*	*vagrants]*
		n	*s/nn*	*n*

The semantic interpretation is as follows:

$\forall t \exists x[\mathbf{arrest}_t$ (POLICE, x: $x \in$ VAGRANT)] [46]

On this interpretation (in line with Schenner's suggestion), the sentence says that at each period/moment *t* the police arrest some vagrant. An implicit existential quantifier which binds the variable 'vagrants' has been chosen for the purpose. This is possible despite the plural of 'vagrant' because, as this quantifier is in the second place, after the universal temporal quantifier, the situation taken as a whole and described in this sentence may involve (and usually does) the presence of many vagrants. At various times different vagrants are arrested, even if at any point in time only one is. What is in need of being commented is rather the universal

[45] The grammar of the languages mentioned above admits *scrambling* and *pseudoscrambling* in relative speech (because normally the interchange of subject and object is reserved to mean the interchange of the order of predicate arguments), so the analyses are performed on clauses beginning with 'that' – The grammar of the languages mentioned above admits *scrambling* and *pseudoscrambling* in relative speech (because normally the interchange of subject and object is reserved to mean the interchange of the order of predicate arguments), so the analyses are performed on clauses beginning with 'that' – although the very 'that' does not belong to the sentences under analysis and I would skip it.

[46] Implicit quantifiers are shown in italics.

temporal quantifier here. The point is that in normal contexts universal quantifiers are often not interpreted literally: for all and every. They are either stereotypical quantifiers ('politicians always lie') or quantifiers limited to relevant situations, the latter being taken implicite and strictly pragmatically. Here – the police arrest vagrants whenever they see them.[47]

The non-standard quantifier order in sentence (1b) suggests that something must be changed. Working within the general rules of (*pseudo*)*scrambling* we should begin by changing the order of the implicit temporal quantifier (general) and the implicit existential quantifier over 'vagrants'. This cashes out to:

$\exists x \forall t$ [$\mathbf{arrest}_t$ (POLICE, x: $x \in$ VAGRANT)].

This sentence says that the police arrest some vagrant all the time. Such an interpretation is incorrect though. The police do not normally arrest one vagrant, or even a group of vagrants, at every point in time (repeatedly, non-stop). We reject this interpretation as factual nonsense.[48]

Since this route is closed, we must try deeper modification. We recall that the quantifier 'always' is not always a temporal quantifier. In some contexts it can be treated as an ordinary object quantifier (always = every).[49] Our sentence then takes on the following interpretation:

---

[47] Semantics, too, occasionally deals with the problem of determination of the range of object variables. One theory holds, for example, that the relevant information must be given in the semantic interpretation in the form of the so called restrictive clause, even if it does not occur on the 'surface' of the sentence. Such a solution is invoked by, for example, von Fintel (1997, p. 9), who analyzes Quine's example: 'Tai always eats with chopsticks'. The sentence does not say, of course, that at every moment some/every Tai eats with chopsticks. It only says that every Tai eats with chopsticks at all those times when he does eat. Supporters of the semantic solution (semantic (tri)partition), such as Schenner, believe that the actual sentence runs as follows: Whenever a Tai eats, he eats with chopsticks. Von Fintel, who makes it the main subject of his work quoted in the present book, seeks to oppose this view and propose a pragmatic solution. It is a step in the right direction, but I can't accept it without qualification. He wants to preserve the restrictive clause in the semantic structure (p. 10), only in a less than fully specified form. Its full specification would depend on things such as, for example, *topic/focus* articulation. I take the view that without considering a broadly understood communicative situation we cannot extract from the sentence alone information as to whether at any point in the history of the world some Tai The Eater always eats (with chopsticks). Predicting a place for such information in the syntactic structure seems to me an irrational exercise.

[48] There is a rather weak semantic reason for rejecting this interpretation: the small quantifier at the front may suggest (but no more than that) that we mean just one vagrant in the overall situation. This, on the other hand, conflicts with the plural. However, we may mean as well a certain group of vagrants (but not all), in which case this argument fails. The interpretation is not always pragmatically incorrect either. Suppose we didn't mean 'arresting' but 'asking for identification' and the police have decided to remove the vagrant (group of vagrants) from Waterloo railway station by constantly asking him for identification (giving him a lot of hassle). We could then assume, quite literally, that there is a vagrant whom the police keep asking for identification at every point in time (allowing for our rather infrequent and discrete clocking up of those points in time).

[49] For quantifier variability, see the previous chapter. We can appreciate this by considering the following example: 'Alpinists *always* fall to their death *in the end*'. The sentence looks suspect

$\forall x\ \exists t[\mathbf{arrest}_t\ (\text{POLICE}, x\!: x \in \text{VAGRANT})]$,

and says that for every vagrant there is a point in time at which he is arrested by the police. Since the temporal quantifier is now the implicit quantifier and should not, as such, be given more prominence other than the event happens in a certain place and in a certain manner, we will finally adopt the following interpretation:

$\forall x[\mathbf{arrest}(\text{POLICE}, x\!: x \in \text{VAGRANT})]$

(Every vagrant is arrested by the police.) [50]

*

(2a) […dass] Otto immer Bücher über Wombats liest
Otto always books about wombats reads

(2b) […dass] Otto Bücher über Wombats immer liest
Otto books about wombats always reads

The interpretation is very similar as in the case of sentences (1a)–(1b), except that instead of the generic name 'the police' we have an ordinary individual name 'Otto'. (2a) says that, when he does read, Otto always reads books about wombats. (2b), on the other hand, says that Otto reads all books about wombats (that he can get hold of). The difference we can make out here is that the meaning with switched quantifiers, rejected in (1b), is not totally absurd: there may just be a book or a series of books about wombats that Otto reads all the time. This is still a highly unlikely interpretation: it evokes the image of a hunched-over bespectacled nerd who does not part company with books (stained with bits of food), who reads even as he speaks, goes to a party or a theatre. But as a kind of hyperbole this meaning is plausible. Otto's mother could utter this sentence in an answer to his uncle's question should the latter ask if Otto had already read the book about wombats he had given him.

*

(3a) […dass] immer Kinder auf der Strasse spielen
always children in the street play

(3b) […dass] Kinder immer auf der Strasse spielen
children always in the street play

---

in the precise register: two temporal quantifiers side by side do not look good. In everyday language the sentence sounds quite natural and says that *every* alpinist falls to his death at a certain point in time (referred to as 'the end' here).

[12] It bears repeating that the relativization that is not declared explicite should disappear from the syntax and the semantics (implicit quantifiers are not taken into account unless they interact with the explicit ones). Otherwise we wouldn't be able to consider any expression a complete one.

Now with a changed word order in (3b) the correct interpretation is an interpretation with the quantifiers reversed, on condition that the implicit quantifier over children is a general stereotypical quantifier, on account of 'children' being a plural noun.[51] (3a) means that at *each* point in time *some* children are playing in the street. (3b) means that *every* child *always* plays in the street, where 'always', for pragmatic reasons, must be taken to mean 'whenever the child does play'. It is obvious that children do not play all the time. Were we to take this quantifier literally, the sentence would be clearly false, regardless of whether the children are playing in the street or in a well-equipped playground.

*

(4a) […dass] Peter immer auf Freunde wartet
Peter always for friends waits

(4b) […dass] Peter auf Freunde immer wartet
Peter for friends always waits

(4a) says that at *each* point in time there are *some* friends that Peter is waiting for; (4b) says that Peter is waiting for *every* (stereotypical quantifier because of the plural form of the first name) friend at *each* point in time.

*

Let us round off our discussion of pseudoscrambling with an interesting example of proper scrambling:

(5a) […dass] Philosophen Logikbücher lesen
Philosophers books about logic read

(5b) […dass] Logikbücher Philosophen lesen
Books about logic philosophers read

There are no quantifiers here binding any implicit arguments of the predicate. There are however two general names in simple supposition in the subject and object. Both can be quantified. The quantifiers are only of the implicit type: the first, as commanded by the plural, is a universal (stereotypical) quantifier; the second, an existential one.[52] Thus (5a) says that every philosopher reads some books about logic; (5b) says that every book about logic is read by some philosopher.

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[51] The plural of the first quantified name strongly suggests universal quantification; with other names, this need not be so, because plurality may come from, for example, ensuring agreement with different periods and places. See earlier.

[52] However, the actual context may make the second also a universal quantifier, as in: 'Children like teddy bears'. The implication is: all teddy bears. The example is a good illustration of the pragmatic determinants of scrambling. The question is: in the pair of setnences 'Children like teddy bears' – 'Teddy bears like children', are we dealing with a changed order of arguments of the predicate on the syntactic level or only with a changed order of quantifiers (scrambling)? The example with teddy bears supports the first possibility (with a drop of natural anthropomorphism on teddy bears, of course). The second possibility is less likely as both quantifiers are implicitly

A change from the apparent temporal quantification to actual object quantification – as in sentence (1b) but without scrambling – can be seen in the following example (von Fintel 1997, p. 6)

(6) ‘I usually like a foreign movie’

The syntax is trivially simple. The standard first step in analyzing the semantics is:

(6a) USUt $\forall x$ [**like**$_t$ (I, x: $x \in$FM)] or

(6b) USUt $\exists x$ [**like**$_t$ (I, x: $x \in$ FM)].

(6a) says that in most periods of my life I like all foreign movies. (6b) says that for most periods of my life there is a foreign movie that I like. In most natural contexts both versions are pragmatically inappropriate (they violate one of Grice’s maxims). An example of such context is the question: ‘Are you coming to the cinema with us? There is some foreign movie on.’ The sentence we are analyzing, understood as an affirmative answer to the question (and stating a reason for being so), should not say anything about most periods of the speaker’s life. The time is here and now. By referring to periods of his life, the sentence violates the maxim of relevance. We must assume then that the quantifier ‘usually’ is in fact an object quantifier over movies (equivalent to ‘most’) and interpret the sentence in the following way:

(6c) MOST x [**like**(I, x: $x \in$ FM)],

which means: I like most foreign movies (so I’ll come along with you).

Finally, let us have a look at a well-known example which may appear to be a counter-example to our assumption that the order of quantifiers in normal circumstances is determined by the order of individual variables they bind. As mentioned earlier, our assumption does admit exceptions – a pragmatic context may override it. It is always advisable though to minimize the number of potential counterexamples.

(7) Every linguist knows two languages (Chomsky)

It’s been told that this sentence is ambiguous due to the two possible orders of implicit quantifiers.

(a) $\forall x \, \exists_2 y$ KNOWS (x: $x \in$ **linguist,** y: $y \in$ **language**)

(b) $\exists_2 y \, \forall x$ KNOWS (x: $x \in$ **linguist,** y: $y \in$ **language**)

---

universal and changing their order makes little difference. Whereas in example (5b), in the main body of the text, only the second option is acceptable, because the first is absurd: books do not read philosophers.

In the first case, for every linguist there are two languages that he knows , but it could be different languages for different linguists, whereas in the second case there are two particular languages, very special ones, such that every linguist knows these two. Let us assume these are English and French. Because in both cases the order of the respective names (*scil.* ‘linguist’ and ‘languages’) seems identical, the ambiguity calls for some explanation.

I would say in defence of myself that the standard meaning of (7) is only (a). Meaning (b) would be conveyed by a sentence of a different form: ‘There are two languages that every linguist knows’ or something like that. And even if (7) is really ambiguous, the other meaning is not (b) but rather (b’):

(b’) $\forall x$ KNOWS (x: $x \in$ **linguist, Twolanguages**)

where **Twolanguages** is an individual generic name for English and French together. Exactly as ‘Three Musketeers’ is a name for Atos, Portos and Aramis.

4.3.2.2 Two Hard Examples

After this warm-up let us try some examples widely cited in the literature as hard cases. Let’s start with an example given by Schenner after Barbara Partee:

‘A man who *always* agrees with *whoever* he is talking to *never* tells *only* the truth.’

Syntax. We have four explicit quantifiers here and – as we will see – three more implicit ones. One of the latter is an implicit quantifier for the name ‘a man who always agrees with… talking to’. It is a general quantifier, as the sentence expresses a sort of a stereotype, which is suggested by other quantifiers, which are from a pragmatic point of view massively over-general (Table 4.3.2.2.1):

Table 4.3.2.2.1 *Example 9*

[Every]$_a$	*[never]*$_b$	*[only]*$_c$	*{[A man who…*	*talking*	*to]*$_a$	*[tell]*$_b$	*[truth]*$_c$*}*[53]
			|		*s*		|
			|	*n**	||	*s/nn* ||	*n* |

Now, we have to deal with a remarkably complex name (Table 4.3.2.2.2):

---

[53] Indices at quantifiers are just a technical device to help to remember where the quantifiers are applicable. Implicit quantifiers are in italics. Some quantifiers are not visible on the surface because there are names made out of sentences (by nominalizing functors like ‘who’, ‘that’ etc.). Quantifiers from these sentences do not appear in the sentence in which the name is a part.

Table 4.3.2.2.2 *Example 9′*

n=*	*A man*	*who*	*always*	*agrees*	*with*	*whoever*	*is*	*talking*	*to*
	|……….|	| *n/s* |	|……………………………			…*s*……			……………………………|

which gives us a sentence with another implicit quantifier, this time existential, binding the name ‘A man’ (Table 4.3.2.2.3):

Table 4.3.2.2.3 *Example 9″*

[there is]$_d$	*[always]$_e$*	*[whoever]$_f$*	*{[A man]$_d$*	*[agrees with]$_e$*	*[one (that) he is talking to]$_f$}*
			|	s	|
			| *n* |	| *s/nn* |	| *n* |
					|….| | *n/s* ||………*s*……………|

Here we have another sentence with another implicit existential quantifier binding the name ‘(some)one’ (Table 4.3.2.24):

Table 4.3.2.2.4 *Example 9‴*

[there is]$_g$	*{[he]*	*[is*	*talking*	*to]*	*[someone]$_g$}*
	|		*s*		|
	| *n* ||		*s/nn*	||	*n* |

Once we’ve got the syntactic atoms and the structure, we can build up the semantic interpretation of the whole. So, to begin with, we have a simple situation where a certain person (referred to by the pronoun ‘he’) is talking to someone:

(s) $\exists x$ IS TALKING TO (he$_{\text{const}}$, x)
he is talking to someone

We guess – on pragmatic grounds – that there is a person the speaker refers to by ‘he’. In fact we do not know exactly who ‘he’ is; it is ‘a’ person for us, but he will not be represented by a variable: the pronoun informs us that when we proceed in semantic interpretation, we will find identifying information somewhere further.

Then, by the nominalizing functor ‘that’ we get the general name of such persons to whom this ‘he’ is talking to:

(n) x: IS TALKING TO (he, x) – nominalizing functor ‘that’
Such a (person) to whom our ‘he’ – whoever he is - is talking

We store this in our memory for later. In the meantime we also consider a quite simple situation in which a man agrees with someone. Then we substitute for the

indefinite ‘someone’ the name we have built and stored a moment ago; we get a situation in which a man agrees with someone he is talking to. Now we notice a general quantifier for the interlocutors, so we understand that our ‘a man’ agrees with *everyone* (=whoever) he is talking to. And we begin to wonder what it means that he (‘a man’) *always* agrees with whoever he is talking to. For a moment we entertain the idea that there is a man who at every moment of time is talking to somebody and always agrees with whoever he is talking to, but soon we get serious and assume that ‘always’ in this context means ‘any time he talks to somebody’ (purely pragmatic reasoning).

(s) $\exists y \forall t \forall x$ AGREES WITHt [y: $y \in$ man, x: IS TALKING TO (y, x)]
There is such a man that he always agrees with anybody he is talking to

Here we get the reference for ‘he’: every person substituted for y becomes a referent of the previously underdetermined ‘he’. The hearer hearing ‘he’ may expect a pointing gesture, but he may be satisfied by a personal bound variable as well – according to standard approaches to anaphora. Then, by the nominalizing functor ‘who’ we get a general name of such persons who always agree with whoever they are talking to – and store it for a moment:

(n) y:$\forall t \forall x$ AGREES WITHt [y: $y \in$ man, x: IS TALKING TO *(y, x)*]
– nominalizing functor ‘who’
Such a man that he always agrees with whoever he is talking to; *or*
A man who always agrees with whoever he is talking to

In the meantime we consider a third and relatively simple situation in which somebody never tells only the truth. We notice that it means that he always says something untrue (when ‘always’ means of course ‘at every moment at which he says anything at all’). To this simple situation we apply the name we have just built and stored and we finally get the interpretation saying that every man who always agrees with whoever he is talking to never tells only the truth:

$\forall y \sim\exists t' \forall z \sim$ TELLt' [y: $\forall t \forall x$ AGREES WITHt (y: $y \in$ man, x: IS TALKING TO *(y, x)*), z: $z \notin$ truth]
(note: ‘only S is P’ means ‘every non-S is not P’)

or by de Morgan laws:

$\forall y\ \forall t'\ \exists z$ TELLt' [y: $\forall t \forall x$ AGREES WITHt (…), z: $z \notin$ truth]
every man who agrees with whoever he is talking to always says something untrue[54]

[54] In principle we should differentiate saying ‘never tells only the truth’ from ‘always says something untrue’ – the truth conditions of these differ when the subject does not say anything at all. However, with our reservation about the meaning of general quantifiers, the difference disappears.

‘Only one class was so bad that no student passed the exam’[55]

Syntax (Table 4.3.2.2.5):

Table 4.3.2.2.5 *Example 10*

<table>
<tr><th>[Only one]_a</th><th>[(class)_a</th><th>was</th><th>(so</th><th>bad</th><th>that</th><th>no</th><th>student</th><th>passed</th><th>the exam)]</th></tr>
<tr><td></td><td>|</td><td></td><td></td><td></td><td>s</td><td></td><td></td><td></td><td>|</td></tr>
<tr><td></td><td>| n</td><td>|| s/nn||</td><td></td><td></td><td></td><td></td><td>n</td><td></td><td>|</td></tr>
<tr><td></td><td></td><td></td><td></td><td>| n ||</td><td></td><td></td><td>n/n</td><td></td><td>|</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>|n/n//s| |</td><td></td><td></td><td>s</td><td>|</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>| s/s ||</td><td></td><td>s</td><td>|</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>|</td><td>n</td><td>|| s/nn ||</td><td>n |</td></tr>
</table>

Semantics:

~∃*x* PASSED (*x*: *x*∈ **student**, **the exam**) [No student passed the exam; ‘the exam’ is an individual name]

x: x∈ **bad** [something bad]

bad: ~∃*x* PASSED (*x*: *x*∈ **student**, **the exam**) [something bad so that no student passed the exam (the ‘colon phrase’ : ~∃*x* PASSED (*x*: *x*∈ **student**, **the exam**) belongs to category n/n; a colon in standard notation represents a functor ‘such (or so) … that’)]

y: *y*∈ **class** [some class]

$\exists_1 y$ WAS [*y*: *y*∈ **class, bad**: ~∃*x* PASSED (*x*: *x*∈ **student**, **the exam**)]

Only one[56] class was bad so that no student passed the exam.

What is interesting in this analysis is that it does not say the students must belong to the class in question. We can restrict the range of the variable *x* to students of this class if the context suggests so – on the pragmatic grounds. However, the context does not always suggest such restrictions. Consider a case in which we decide about a certain whole (e.g. shipment of fruit) on the basis of testing a sample. We can perfectly well say that a given box of apples was so bad that no apple

[55] von Fintel 1997, p. 12 – this is the source of the example only, not the analysis.

In fact we should distinguish between ‘he never tells only the truth’ and ‘he always says something untrue’; the truth conditions of these statements are different when our chap does not say anything. I believe however (and this belief is justified above/in these pages) that the universal quantifier must be read with the following qualification in mind: ‘if anything is said, then …’. In such circumstances the two statements are equivalent.

[56] Despite superficial similarities, the quantifier ‘only one ...’ functions in a completely different way than the quantifier ‘only’ discussed previously. It is simply a numerical quantifier: ‘there is exactly one’ reserved for situations where one might expect more than one object of a certain kind.

would be allowed for sale – meaning no apple from the whole shipment at all. The restrictions on range are not in the syntax here, but solely in pragmatics. [57]

4.3.2.3 Quantification of Compound Sentences

So far we have dealt with simple sentences only. Even the hard examples were, on the first level, simple sentences with one predicate. Compound sentences represent a more interesting case in that we have to decide which parts of a longer utterance are within the scope of which quantifier.

(10) **‘**When Kim visits her parents, she often takes the train’ (von Fintel 1997, p.3)

The word ‘when’ is a functor correlating two situations denoted by two sentences; thus it is a connective belonging to category *s/ss*, whose semantics is close to implication. The only temporal quantifier is the word ‘often’. We can tell this by seeing that the order of ‘when’ and ‘often’ can be easily changed without a change in the meaning (‘Kim often takes the train when she visits her parents’).[58] What must be preserved is the order of ‘when’ and ‘Kim visits her parents’ – because the change of this order would reverse the order of arguments of implication: ‘When Kim takes the train, she often visits her parents’ means something completely different. As for the rest of the sentence, ‘Kim’ is an individual name; ‘her parents’ – in this context – is a collective individual name referring to both of Kim’s parents. ‘The train’ is a general name quantified by an implicit existential quantifier.[59] It is worth noting that all equivalent paraphrases put ‘often’ before ‘the train’.Thus (Table 4.3.2.3.1):

[57] I think that we can expect to find such underdeterminate ranges wherever we encounter functors from sentences to functors. Such sentences can be only loosely connected with the operation of functors which have been built from them.

[58] If there were two quantifiers here, we’d be looking at (pseudo)scrambling. This would raise doubts about the equivalence, if not cause a complete change of meaning. But nothing of the kind is to be seen here.

[59] Note that this is a quite unusual interpretation for a noun determined by ‘the’. It suggests that perhaps we have to do with a metonymy here. ‘The train’ stands not for a physical object (which is obviously indefinite in this case), but for an abstract line. If Kim’s parents live in Brighton, it stands for the ‘train’ (meaning: line) from London to Brighton as opposed to, say, the train (line) from Edinburgh to Glasgow. Such a line is a relatively definite thing, I guess.

Syntax:

Table 4.3.2.3.1 *Example 11*

[Often$_t$]	*[Q$_{train}$]*	*[when*	*(Kim*	*visits$_t$*	*her*	*parents),*	*(she*	*takes$_t$*	*the train)]*
						s			
		s/ss			*s*			*s*	
			n	*s/nn*		*n*	*n*	*s/nn*	*n*
					n/n	*n*			

Semantics:

OFTENt $\exists x$ [VISITS$_t$(**Kim, her parents**) → TAKES$_t$ (**Kim,** x: $x \in$ **train**)]

All the difficulty is hidden in the question how to interpret the quantifier ‘often’. In this context it is reasonable to suggest that it should be understood in the following way: the whole compound sentence is true iff the sentence ‘Kim takes$_t$ the train’ is true at most times at which the sentence ‘Kim visits$_t$ her parents’ is true. (One can call it quantification over situations, but the situations are represented here by their temporal index).

*

An interesting variation on the above sentence is the sentence:

(11) ‘When Kim visits her parents, she often feels depressed the next day’

What we’ve got here is an adverb of time ‘the next day’. It is interesting to note that it does not refer to some specific time (temporal constant) but rather modifies, by a constant value (here: by adding one day), a temporal variable, independently quantified. Thus, we are best advised to represent the syntax as it would normally be done for all adverbs (Table 4.3.2.3.2):

Table 4.3.2.3.2 *Example 11′*

[often] [when (Kim visits her parents), (she feels depressed the next day].
ǀ s ǀ
ǀ *s/ss* ǀǀ *s* ǀǀ *s* ǀ
ǀ *n* ǀǀ *s/nn* ǀǀ *n* ǀǀ *n* ǀ *s/n* ǀ
ǀ*n/n* ǀǀ *n* ǀ ǀ *s/n* ǀǀ (*s/n*)/(*s/n*) ǀ

In terms of its semantics, the sentence looks as follows:
OFTEN t [$\textbf{visits}_t$ (Kim, her parents) → $\textbf{feels depressed}_{t+1}$ (Kim)].[60]

*

Let us now proceed to the famous ‘donkey’ anaphora:

(13) ‘If a farmer owns a donkey, he beats it’

The sentence contains two general names in simple supposition (quantifiable). It has thus two implicit quantifiers at the front: one over farmers, one over donkeys. The syntax looks like this (Table 4.3.2.3.3):

Table 4.3.2.3.3 *Example 12*

[Q_{farmer}] [Q_{donkey}] [If (a farmer owns a donkey), (he beats it)]
ǀ *s/ss* ǀǀ *s* ǀ *s* ǀ
ǀ *n* ǀǀ *s/nn* ǀǀ *n* ǀǀ *n* ǀǀ *s/nn* ǀǀ *n* ǀ

In terms of semantics, we can distinguish four separate meanings corresponding to four possible quantifier combinations.

(13a) $\forall x \forall y$[**owns**(x: $x \in$ FARMER, y: $y \in$ DONKEY) → **beats** (x, y)]
(13b) $\exists x \exists y$[**owns**(x: $x \in$ FARMER, y: $y \in$ DONKEY) → **beats** (x, y)]
(13c) $\forall x \exists y$[**owns**(x: $x \in$ FARMER, y: $y \in$ DONKEY) → **beats** (x, y)]
(13d) $\exists x \forall y$[**owns**(x: $x \in$ FARMER, y: $y \in$ DONKEY) → **beats** (x, y)]

Sentence (13a) takes on a stereotypical interpretation and says that in all pairs <farmer; donkey> the farmer beats the donkey. This is a natural and usually intended interpretation. Sentence (13b) says that there are: some farmer and some donkey such that if the donkey belongs to the farmer, then the farmer beats the donkey. This interpretation is pragmatically odd. The oddity comes from the implication functor being used with existential quantifiers. We would normally

[60] Assuming that the time unit is one day. Generally, an adverbial phrase of this sort, which is supposed to place a time index beside the predicate, can be very complex, e.g. ‘Kim feels depressed three days after the birthday of the president of the company which owns the factory in which Kim’s kimono was manufactured’. Such a phrase must be analyzed separately and only the semantic result of such an analysis (*scil.* some date) is taken to the interpretation of the main sentence.

expect to find a conjunction here, in which case the sentence would not run: 'If a farmer owns a donkey', …, but: 'A farmer owns a donkey and he beats it'.

Sentence (13c) says that every farmer beats one particular donkey from among the donkeys he owns – a 'scapegoat', in a manner of speaking. Other donkeys are left alone. Empirical research (Geurts 2002) shows that interpretation of 'donkey sentences' (sentences exhibiting an analogical structure, even if they involve a reference to other things), depends on the subject area and the speakers' ontological commitments in that area. According to his findings (13c) can be also regarded as one that has been intended. Sentence (13d) says that there are farmers who beat all the donkeys they own. Such interpretation is rather unintended for the reason that this information can be expressed in a simpler way, using other linguistic means (There is a farmer who beats all his donkeys).

Other examples of donkey anaphora: [61]

(14a) 'If a donkey isn't in the backyard, we usually feed it.'

(14b) * 'If there isn't a donkey in the backyard, we usually feed it.'

The above sentences differ in their acceptability: the first one is acceptable, the second is not. The difference results from the relative position of the quantifier and the negation and means that in the second sentence we cannot be sure if any donkey exists. We cannot cross-refer the pronoun to it, then. The semantic difference, according to our notation, is as follows (the syntax is fairly simple and we can disregard the categorial analysis).

In (14a) 'If' is a sentential connective; the first quantifier is a hidden existential quantifier for the donkey variable, the second one is an explicit temporal quantifier:

$\exists x$ USU t [~**is (located) in**$_t$ (x: $x \in$ DONKEY, BACKYARD) $\rightarrow$ **feed**$_t$ (we, x)].

In (14b) it is the donkey quantifier that is explicit. It is integrated with the predicate of the first sentence ('there isn't' is both a quantifier and a predicate at the same time)[62]. The symbolization is as follows:

*USU t [~$\exists x$ **is (located) in**$_t$ (x: $x \in$ DONKEY, BACKYARD) $\rightarrow$ **feed**$_t$ (we, x)]

[61] von Fintel (1997, s. 36).

[62] Belonging to the standard predicate calculus the phrase 'there is no such x, that x is P' would be awkward in natural language: it would sound uneconomical first and provocative second. In many natural languages the negated existential quantifier together with the predicative copula 'be' is, in such circumstances, collapsed to 'There isn't a P'. In the semantic representation, this abbreviated form must be expanded.

There is a free variable in the consequent – hence the symbolization is incorrect[63]. That does not mean that no pronoun is allowed in the consequent. We can legitimately have a pronoun there but it must refer to something else, for example, to 'backyard':

(14c) *If there isn't a donkey in the backyard, we usually clean it.*

where 'it' means 'backyard' this time:

USU t [$\sim\exists x$ is in_t (x: $x \in$ DONKEY, backyard) $\rightarrow$ clean_t (we, backyard)].

Put this way, all order is restored.

[63] This can work on distance, as well. The sentence: 'Only if a donkey has been in our stable for a long time do we let it run around freely' (the implicit donkey quantifier ranges over the whole compound sentence) is correct, while the sentence: *'Only if there is a donkey that has been...' is not. In the latter example the quantifier is integrated with the predicate of the consequent; a free variable occurs in the consequent. Just like before, we can make it a correct sentence by interpreting the pronoun in the consequent as referring to something else – here, for example, to the stable: *...we can call it 'Donkeyhouse.'*

5 CONCLUSION

The Philosophy of Syntax is a work dedicated to the analysis of fundamental intuitions about the theory of natural language syntax taken as a tool for referring to the world and describing its phenomena. The analysis is based on two main assumptions. First, it is assumed that important aspects of language, in particular of its syntax, owe their emergence to the way in which it has been acquired. The theory of syntax, which like any other theory is only an idealization, may abstract away from a number of well-established aspects of language, which would only make the general picture unclear, but cannot disregard the way in which language can be acquired (what are the sources of information about language for someone who does not speak any language yet).

Secondly, it is accepted that the actual linguistic competence of speakers of a particular language is determined by factors which can be grouped under each of the three main heads of semiotics: syntax, semantics and pragmatics. This view does not admit assertions that linguistic competence can support purely syntactic considerations (as argued by generative grammarians). In line with our assumption, we must refrain from testing the theory of syntax in purely empirical terms. The sense of acceptability, or unacceptability as the case may be, of an expression felt by a competent speaker of a language does not manifest itself in syntactical correctness only.

It is proposed instead to base the theory of syntax on a few fundamental intuitions, which are taken to be postulates. These intuitions are analyzed in *Syntax*. The chapter also discusses the attendant controversies and provides the rationale for the adopted strategy. The main focus of our considerations there is on the Functoriality Principle (FP), which lies at the basis of categorial grammar. I analyze its classical definition and describe the three levels which it distinguishes.

On the level of syntactic positions (FPa), FP says that every well formed expression contains exactly one constituent which is the operator; the other constituents are its operands. On the level of semantic categories (FPb) FP says that the constituent which is the operator is the functor, which, together with the arguments belonging to the same semantic categories as the operands of the operator, constitutes a complex expression belonging to the same semantic category as the expression in which the functor acts as the operator. On the level of FP(c), the functors denote functions (so called Ajdukiewicz functions) which assign denotations of complex expression to the denotations of those functors' arguments.

Next I set out four postulates which concern the fundamental intuitions underlying the notion of semantic categories, so critical to FP, and governing the relations between its levels. Analysis of these postulates gives rise to all kinds of interpretational doubts, whose clarification bears on the final understanding of FP and in the end on the general picture of language and detailed methods of syntactic analysis.

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First, I adopt the principle of interchangeability (IP) as a necessary and sufficient condition of expressions belonging to the same semantic category. This means that whenever we find two expressions in a sentence to be interchangeable without affecting the meaning and the syntax of the rest of the sentence we are justified in treating these two expressions as belonging to the same category. This further means that if in a syntactically coherent sentence we replace an expression with another which belongs to the same category, the sentence will remain syntactically coherent.

In many cases such replacement alters drastically the acceptability of the sentence (tendency of ordinary speakers of the language to view the sentence as either normal or anomalous). IP then ensures a separation of the theory of syntax of which it is a part and direct empirical evidence (declarations of informants). Moreover, the principle separates the notion of grammatical coherence (grammaticality in the logical sense) and grammaticality sensu stricto (in the linguistic sense); it is often the case that an expression which is ungrammatical in the traditional sense is actually syntactically coherent. I accept both these consequences in this work and dare say they are desirable. They guarantee a relative autonomy of the theory of logical syntax – relative to the speakers' linguistic intuition which itself comes from a variety of extra-syntactical sources, and relative to traditional grammar, which is often entangled, from the logical point of view, in a random historical development of a given ethnic language.

Secondly, I maintain that semantic categories divide into two main groups: basic (primitive) and functor (derived). The *fundamentum divisionis* I eventually support (having first discussed other possibilities I have come across in the literature) is independence versus dependence of the meaning of expressions belonging to particular categories. This approach is motivated by Frege's view according to which in order to create an independent whole we must combine an independent constituent (object) with a dependent, unsaturated one (function, concept). I further claim that expressions which are semantically independent are connected with the cognitive mechanism of intentionality (which requires that expressions be interpreted as referring to something rather than being sounds or arabesques only). Following Husserl (and Ajdukiewicz) I distinguish two basic categories: names and sentences, connected respectively with nominal intentional attitude (naming) and propositional intentional attitude (stating).

Thirdly, I narrowly define the claimed syntactic-semantic relationship to be a total of relations between the levels FPa, FPb and FPc. I hold in particular that every expression which occupies the position of an operator must be a functor, and each functor must designate the appropriate Ajdukiewicz function. As regards the reverse relation, I claim that between the levels FPc→FPb the designate's ontological category does not determine its semantic category. Both functor and sentence correlates can be named, if we choose to refer to them, and in so doing become name correlates. At the level FPb→FPc on the other hand, each functor in a complex expression belonging to a basic category must be an operator or a part of

an operator on some level of syntactic analysis. In other words, there are no names or sentences which consist solely of functors.

Fourthly, I investigate intuitions connected with the principle of types and the atomicity principle. In accordance with the principle of types, basic categories are assigned simple types (e.g. *n* and *s*), while functor categories are assigned complex types. The latter indicate the type of expression formed by a given functor and type of arguments of the functor (e.g. *s/n* for a one-argument predicate). Owing to such assignments, it is possible to determine the type of a complex expression once we know the types of all its constituents. This possibility is captured by the atomicity principle. In my analysis I seek to emphasize that appropriate type assignments make it possible to work in reverse: given the type of a complex expression and the types of arguments of its main functor we can determine the type of this functor.

I argue that reverse determination is often at the basis of a syntactic analysis of expressions. This is because we often do not know the initial assignment of types to all atomic lexical items, in particular to the semantically dependent functors. In this connection I invoke the difference between type and category: categories are sets, types are symbols. In practical application, the difference becomes apparent when we are faced with the task of defining them. Types, especially basic types, can be simply stated. With categories, their members must be enumerated.

Finally, considerations of the foundations of FP suggest a way of how, realistically speaking, we can go about determining the syntax of an expression (categorial-semantic analysis).

When we embark on the semantic analysis of any natural language, say, when we learn to speak as children, we have no access to a purpose-made categorically indexed dictionary of that language. We are only exposed to basic category utterances and their situational context. Guided by that, we assign categories to some words and to many complex expressions (mostly sentences but also names) without knowing their syntax at all. Only as a next step do we work out the functor categories for functors which have occurred in expressions whose category is by now familiar, and determine the syntax of those expressions. (For this to be possible we must rule out situations where an expression belonging to a basic category consists only of functors. Conversely, our expression may include only one functor which is an operator on the first level of the analysis.) In this way we determine the so called ‘bases of categories’. In time we learn to assign more and more expressions to appropriate categories thanks to the principle of interchangeability. In so doing we get to a stage where we develop some sort of provisional dictionary – never a complete one though – which matches most functors with typical categories and typical contexts. This information can then be used in building new sentences, in accordance with the principle of atomism, and in devising a technical language with its own fixed matrix of meanings and categories. We must always reckon though with the possibility of encountering one of our expressions in a non-technical sentence where it does not match a previously selected category. Such sentences must then be defined directly (via situational contexts).

The first part concludes with a chapter which sets functoriality principle in the context of general considerations: consideration of 'localization' of syntactic operations and considerations of compositionality. As regards the former, I show that FP facilitates an intra-linguistic approach to syntactic operations (in the literature this approach is referred to as 'the lexical approach': syntax is worn on the back of words). All syntactic information about an expression is contained in the expression itself (via category assignment of this particular expression and all assignments of expressions belonging to basic categories which it is comprised of). No additional rules are necessary. I argue that this approach is crucial for the correct acquisition of syntax. The truth is that no rules are taught in the early stages of language teaching.

As regards the latter consideration, I maintain (contrary to popular belief) that FP takes a neutral stand in the dispute between the adherents of compositionality and the supporters of contextuality. In my view, the whole dispute seems to be exaggerated and to be mistakenly staged against the backdrop of the logic of language. I believe it pertains to language practice – the practice of studying and analyzing syntax. The dispute is not motivated by the question of what is a function of what: is the meaning of the whole a function of the meanings of its parts, or reversely (the two are not mutually exclusive)? Rather, the question is about what is *given* during language acquisition or at the start of a categorial analysis: single words or complete contexts. I think that the dispute ought to be resolved by compromise: in the early stages of language learning or in everyday speech contextuality should take precedence. Compositionality is best suited to natural technical language.

The chapter *Semantics* examines some consequences of the proposed conception of syntax for selected semantic considerations (or, put differently, how certain aspects of semantic theory should be organized so that the theory harmonizes with the proposed theory of syntax).

I claim that the acquisition of syntax must be closely connected with the ostensive procedure, which, in the early stages of first language acquisition, is the only method of communicating new information. Examination of the ostensive procedure leads to the conclusion that it can be used in defining a large number of expressions belonging to basic semantic categories (both sentences and names), which helps to create bases of those categories and to categorize further expressions by means of the principle of interchangeability.

Next I turn to a more detailed discussion of selected points and outline the theory of ostensive meaning of names and sentences. The theory is a variant of the so called prototype (or stereotype)[1] theory of meaning, according to which the meaning of an expression – not just its denotation, as claimed by traditional theory – is determined by the objects referred to in the ostensive definition of the expression

[1] The term 'causal theory of meaning' is also commonly used. However, I do not wish to get involved in the dispute about the definition of causality relevant for this theory, so I do not use this term.

in question. I discuss problems connected with this theory: the problem of vagueness, the problem of public and private meaning, as well as the problem of natural kind concepts. I argue that a pragmatic approach to the problem of vagueness yields promising results. I distinguish a sensu stricto meaning, which is a 'private' meaning, a meaning relativized to a particular speaker, and a *sensu largo* meaning, which is a public meaning and one common to all speakers of the language. The private meaning changes and evolves in the course of learning a language, and its evolution runs along convergent lines for different speakers. Eventually the shift to the public meaning takes the form of a certain idealization – a belief that, of each object we encounter, we are able to state whether it is a designate of a given expression or not – followed by a hypothesis that everyone will have idealized the meaning in the same way. This hypothesis explains why interpersonal communication is possible and why it usually takes place without strain. In certain circumstances though (e.g. paradoxes of vagueness), the hypothesis may be falsified. Conversational partners must then come up with new idealizations. As regards natural kind concepts, I claim that they do not differ from the so called appearance concepts, either genetically (the same ostensive procedure is used for their introduction) or logically. Both are a result of the taxonomic ability and in both cases one can enquire about the principle which brings together the designates so classified (i.e. about their connotations). Only scholarly analysis can draw a distinction between the two (demonstrating that some of these concepts are connected with natural laws and some are not). This has no bearing on the theory of language though. The problem is one on which I engage in a polemic with Jerry Fodor.

I begin to sketch the theory of ostensive meaning of sentences by arguing that a sentence designate is not a truth value but a situation. Further, this situation must be experienced as being concrete, tangible and known by direct observation. In taking this stance I reject Frege's and Wittgenstein's semantics while embracing the views advanced by Barwise and Perry. The key postulate of the ostensive procedure is that sentence designates must lend themselves to being pointed at.

As a basis for further considerations I adopt a situation semantics, which is a variant of Barwise and Perry's conception. The ostensive meaning of a sentence is modeled on the meaning of a name; the definition of meaning is given by reference to a set of prototypical situations identified during the ostensive procedure. As it turns out, this approach leads to a fairly complicated system of constructing complete sentence denotations. The degree of complication is not reduced by the fact that most probably there is no clear line between the ostensive definitions of names and sentences.

Despite that I undertake to show how, in concrete situations, denotations are constructed and how we can determine semantic relations between sentences, in particular relations of semantic entailment. I take on this task without seeking to come down on the side of any of the variants of possible worlds semantics. Employing this theory would simplify matters considerably. However, much as the theory is a good formal tool, it is also counterintuitive. I am thus willing to apply

it in solving a problem only if a solution can be reached, however tentatively and informally, without its aid.

Abandoning the theory of possible worlds leads to a reinterpretation of the relations of inclusion (or being a part of) between situations and thus, in some cases, to reversing the direction of semantic entailment. In particular, the problem of relations between sentences referring to the same elementary situation comes into sharp exposition. I argue that in such cases the direction of entailment does not depend on the denotation of the sentences, which is the same, but on their ostensive meaning, which may contain more or less detail. At this point I make good use of the distinction between the Ajdukiewicz functions, designated by predicates, and relations between the designates of arguments of those predicates. To wit, two sentences which refer to the same situation (and thus to the same relation between the designates of a predicate) may differ in their Ajdukiewicz function. By arguing so, I challenge, among other things, Donald Davidson's conception, as formulated by Parsons (1990).

The last issue dealt with in *Semantics* (related in some measure to the considerations raised earlier) is the problem of distinguishing between a concrete situation-event and an abstract situation-proposition. The problem arises in the context of the so called sentence nominalization, that is, names which refer to situations designated by the given sentence. There appear to be at least two types of nominalization of what are seemingly the same sentences (and following on from that the sentences seem to have two different designates). In this book I discuss the concept of nominalization as proposed by Parsons (1990), Zucchi (1993), and Kratzer (2002) and conclude that, despite successes in flagging up and elucidating different aspects of nominalization, none of them has managed to achieve what I consider the most important goal: a clear and convincing answer to the question of what a sentence designate is.

In view of the above, I propose my own theory, according to which sentences belonging to the object language, such as 'John has arrived,' refer to concrete situation-events (here 'John's arrival'), while abstract situations-propositions (such as 'that John has arrived') are correlates of sentences belonging to metalanguage, such as '*John has arrived* is true'. Assuming the deflation theory of truth does not apply, the solution preserves the principle that one sentence has one semantic correlate and, as a bonus, helps justify certain strategies of syntactic analysis of sentences which contain intensional operators.

Categorial Analysis brings together the conclusions of the previous parts and provides directions for rational strategies of syntactic analysis of particular expressions. It also presents ways of solving or neutralizing some pragmatic problems which prevent the syntactic reconstruction of an expression.

I examine logical form first. Logical form is taken to be the actual syntactic structure of an expression which categorial-semantic analysis seeks to expose. I support the claim that, outside generative-transformational grammar where surface and deep structure are used in a specific technical sense, there are no grounds for drawing such distinctions. The syntactic structure, which is an abstract construct,

is not visible one way or another and must be reconstructed on the basis of information contained in the expression and the relevant theory of syntax. An intuition which points at different levels of 'depth' in a syntactic description is, in my view, an expression of our reliance on the information contained in the expression itself whenever we attempt to render such a description.

There are thus two main conceptions of logical form.[2] Under the first of these, the logical form of an expression is (the obvious syntactic structure which is ascribed to) the expression being a translation of the original expression into a certain formalized (and syntactically ordered) logical calculus (such as Montague's intensional logic). In such cases syntactic information contained in the expression under analysis is used only to a limited degree and only as a general guide for translation (translation rules are largely based on intuition and are not part of any theory). The second conception assumes that categorial analysis applies directly to a given expression and is conducted with reference to that expression employing the few rules the theory of syntax supplies (in particular, the FP). I argue that, in line with the main thrust of my book, the latter of the two is appropriate conception of logical form to apply.

After these decisions, which are meant to round up the theoretical problems still left open in the preceding parts of the book, I turn to the practical rules of categorial analysis meant to be a sort of a summary of earlier considerations. In particular, I propose the *basic categories rule*, according to which in expressions belonging to basic semantic categories all constituents except for the main functor belong to basic semantic categories, and the *superfunctor rule*, whereby the arguments of the functor-generating functor belong either to a basic category or else the same category as the functor generated by the functor-generating functor. They are categorical rules in the sense that they are a synthesis of the possibilities of conducting rational categorial analysis within the presented theory: one cannot do without them. Besides these rules I discuss some facultative rules, whose application often simplifies the analysis but is not always desirable or possible.

As can be gathered from the literature, facultative rules are often motivated by a desire to disambiguate the categorial analysis: make an expression which is not felt to be ambiguous have just one correct analysis. In this book I do not recommend following this route. I distinguish between amphibolies, that is expressions which are syntactically ambiguous, and alternations, or expressions where different variants of analysis lead, on prima facie evidence, to the same meaning. As regards alternations, theoretically one could seek to eliminate all but one variant; amphibolies must by the nature of things have more than one syntactic analysis. I point out, however, that there is no clear borderline between amphibolies and alternations. Classifying an expression which admits different syntactic analyses as either an alternation or an amphiboly often depends on the intended degree of precision of the utterance.

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[2] We are concerned here with certain paradigmatic extremes; there are a number of conceptions to be found in between.

In certain contexts many apparent alternations turn out to be amphibolies where each of the syntactic variants can be matched to some nuance of meaning. Such subtleties are not discernible in everyday speech but they can be important in the precise register of language (e.g. in the technical language of some branch of science or philosophy). This justifies foregoing any attempts at ensuring unambiguous categorial analysis and invites pragmatic criteria in order to help decide which of the possible variants of the analysis should be adopted in the case in question.

Chapter 4 concludes with a review of example categorial analyses, preceded by a detailed key to grammar and notation, and a discussion of analytical strategies applied to typical forms. Combined with numerous illustrations of analyses scattered in other chapters, this adds up to several dozen examples which show a practical application (I hope) of the theoretical conception presented in this book. The last few examples focus especially on quantificational contexts. These are considered to be the toughest test for the theory of syntax. I don't think though that they are the most important. In keeping with my conception, nothing is more important than the relation between the name and the predicate, which results in a sentence.

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The most important contribution which I believe this work makes is in establishing a relative autonomy of syntax. In view of what I said about the semiotic heterogeneity of linguistic competences, there is a hint of a paradox about this contribution, but only at first glance. Loyal adherence to the 'falsification' criterion, typical of many contemporary works on the theory of syntax, in the face of undeniable semantic and pragmatic interference in the forming of judgments of acceptability, demands that all theories satisfy the totality requirement (solve all semiotic problems at one stroke, which is impossible on the knowledge we currently possess) or be condemned for their shortcomings.

Such is the current state of research into the theory of syntax: dozens of competing conceptions, theories and paradigms, all of which provide elegant solutions to certain problems but are completely inadequate in tackling others, and a total lack of any common ground on which one could compare and evaluate these conceptions, theories and paradigms. Abandoning the empirical test requirement, however, makes it possible to separate *conceptually* syntax and pragmatics and enquire into the workings of syntax without unnecessary constraints; quite conclusively too under the assumptions made here.

We are also enabled to appreciate the distinctiveness of syntax and semantics, in spite of their being closely intertwined. Were we, in search of semantic categories, to invoke only the ontological categories of objects (as some interpretations of Suszko's doctrine would have it), our language would not extend beyond the capabilities of a one-year old: we'd be pointing at different things and shouting 'da–da'. And even if we had three hundred thousand fancy ways of saying 'da-da' – I mean words - it would not make much difference. It is not what we say it about but what we say and how we say it that is the measure of how rich our language is.

We owe this not to the differentiation of ontological but semantic categories, which determine the way in which we refer to the objects of our attention. The main kinds of intentionality are manifest in this differentiation; the system of semantic categories can thus be considered to be an important part of the human cognitive apparatus. The idea of making semantic categories depend on the intentional 'referring' to the world was put forward by Husserl and is part of categorial grammar developed by Ajdukiewicz. It is extremely important to appreciate its role: along with the ostensive procedure which is the ultimate source of all non-innate linguistic information it is a fundamental principle underlying the syntax of every language.

Finally, let me say a word about certain important consequences following from our main conclusions – some good, some bad.

Namely, my conception of syntax serves simple and effective strategies of analyzing concrete expressions (the strategies boil down to only two categorial analysis rules) on condition that certain information can be extracted from the context of the expressions under analysis. The strategies require that the analysis be limited to the conceptually independent structural aspects at the expense of adjusting the actual form of the expression, as it is used in a particular context, to extra-syntactic considerations, the last of which being motivated partly by the precepts of traditional grammar, partly by intuition.

Since the so called normal context is usually fairly obvious, syntactic analysis does not cause major problems for a competent speaker of the language, or one who is aware of the rules and analytical strategies. A fortiori it is not too difficult to carry out a syntactic analysis of expressions belonging to natural technical language, free of the more vexing pragmatic considerations. For this reason the conception I have proposed may be a useful tool in bringing out the meaning of natural language expressions whenever precision is a priority but when, for a variety of reasons, the expressions cannot be translated into artificial language, for example in philosophy and other human sciences, as well as in the language of legislators and lawyers. These are the good consequences.

The bad consequences of the conclusions reached here follow mainly for the implementation of natural language in machines.[3] Much of what is obvious or nearly obvious to a human being speaking a given language remains outside the grasp of the computer. It is precisely these aspects, the ones which are inaccessible to computers, that are given special prominence here: ostensive language acquisition or reliance on context in syntactic analysis. In line with our conclusions, speaking in a human voice is not possible without a prolonged process of socialization, or being reared in a family speaking the language. So much at least is needed to develop ostensive bases of semantic categories and acquire the

[3] The rich interaction which exists between philosophy, linguistics and computer science and which can be captured by categorial grammar was noted by van Benthem (2005, p. 25), who quotes extensive literature. These bad consequences then regard an important and widely debated area.

necessary knowledge about the world. If indeed our aim is to teach computers human speech, we must provide a proper upbringing for them rather than teaching them how to perform operations on words only. Whether this is a realistic prospect I cannot say.

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